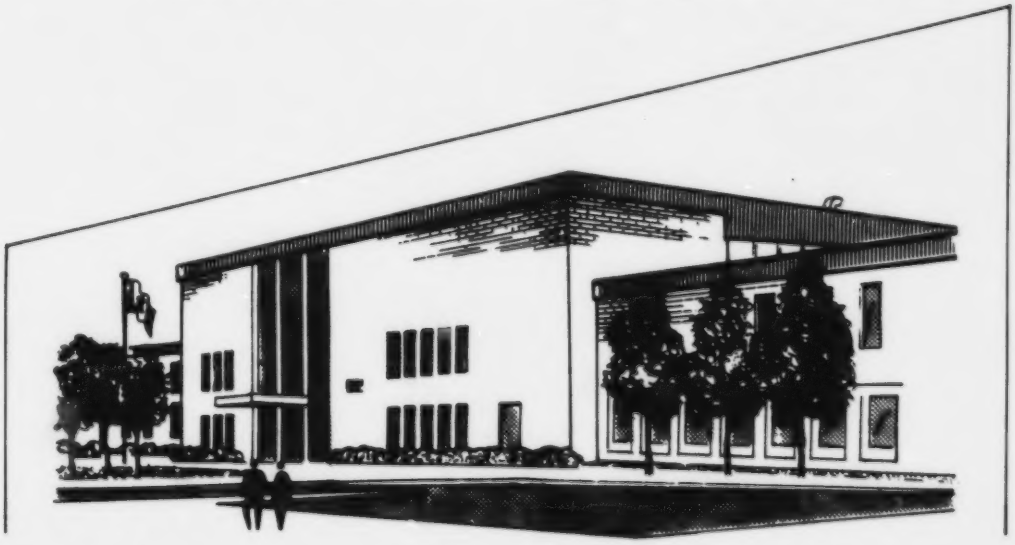
RIVER ROAD ENVIRONMENTAL TECHNOLOGY CENTRE

1986/87 ANNUAL REPORT



technology development and
technical services
environmental protection

Canada

RRETC ACTIVITY REPORT - 1986/87

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INTRODUCTION/HIGHLIGHTS

Background

The River Road Environmental Technology Centre (RRETC) is located in Gloucester, Ontario, close to the Ottawa International Airport. The RRETC is one of two technology centres operated by Conservation and Protection, Environment Canada, in support of the federal mission to protect the environment. RRETC deals primarily with technologies to measure and control air pollutants and spills of hazardous materials. The sister Wastewater Technology Centre in Burlington, Ontario, deals with technologies to control water pollution and residues from industrial and municipal sources. A significant proportion of the technology work is contracted to the private sector.

The activities of the RRETC are summarized on a yearly basis in this Annual Report series. Status reports on projects are also compiled on a quarterly basis. Project results are documented in informal Manuscript (unedited) Reports, and a formal Environment Canada (edited) report series available in both official languages. In addition, staff contribute technical papers to proceedings of conferences and workshops. A summary of reports and papers from the Centre in 1986/87 is included in Appendix A.

Also, a listing of staff members is included in Appendix B.

POLLUTION MEASUREMENT DIVISION (PMD)

The PMD is responsible for the coordination of the National Air Pollution Surveillance (NAPS) Network which currently consists of approximately 425 air monitoring instruments at about 150 sampling stations located in 54 major urban areas in Canada.

Technology evaluation and development work is also undertaken regarding the measurement of parameters such as sulphates, nitrates, inhalable particulates, heavy metals, fluorides, and organic contaminants.

Source monitoring activities include the development of equipment and (standard reference) methods for air emission measurements related to pollutants of emerging concern and for national regulations or guidelines. The Division also has a capability to undertake sample collection and/or continuous monitoring for a variety of stationary sources, and bench-scale research on incineration of hazardous wastes.

Highlights

1. The PMD continued to participate actively in NITEP by preparing manual sampling protocols for SO2, NOx, HCl, THC, CO2, O2 and CO during the characterization and performance phases of the Quebec City municipal incinerator combustion test program. The flue gas monitoring system was designed and built in-house. In reference to the NITEP-Flakt program, the PMD completed final drafts of Volume II and III, provided raw data for Volume IV to Flakt and participated in the re-write of the Volume I draft.

2. A study of herbicide residue samples using the STDS apparatus was completed. A draft report is being reviewed internally. A similar evaluation of the Sydney coal-tar pond sludges has begun.

3. A preliminary report summarizing the emission measurements at the FBC unit at CFB Summerside was distributed to IPB and EM&R.

4. At the request of the Ontario Ministry of the Environment, ambient air measurements of polycyclic aromatic hydrocarbons (PAH) were carried out in Ottawa in the vicinity of a coal-tar cleanup operation at Ecole Notre Dames des Champs on Navan Road and inside the Lees Avenue transitway station. A report was prepared and distributed.

5. A presentation on ozone formation and control was delivered at the Environmental Law Research Foundation Conference "Beyond Acid Rain".

6. A total non-methane organic (NMOC) sampling system using evacuated, passivated stainless steel canisters was tested and a sampling unit was installed at the Robson Square NAPS station in Vancouver. The data will be used to support B.C. MOE/GVRD ozone control strategy development.

7. The PMD participated in a joint EMR/Canadian Electrical Association project at the coal-fired power plant in Estevan, Saskatchewan, to evaluate the effectiveness of SO2 control by dry sorbent injection. Tests were conducted to evaluate the suitability of the sampling locations and the two continuous monitoring systems operated by Saskpower and Combustion Engineering. Data were analyzed and possible causes of the discrepancies in the results were discussed. Recommendations to improve data quality were also made.

8. The source evaluation program at the Hamilton-Wentworth Sewege Sludge Incinerator has been postponed indefinitely due to operational problems. As a substitute, the MOE's Duffin Creek facility was visited in late September and early October. Samples were collected for total particulate, metal, PAH, Dioxin/Furan, PCB, CB and CP analyses. The stack gas concentrations of NOx, SO2, CO2, CO, O2 and THC were also measured. Additional single point samples were also collected in an effort to determine the precision of a proposed PAH method.

9. The procedures for a proposed round-robin testing program for calibration gases were sent to NAPS agencies for review and approval. All agencies replied favourably to the program which began at the end of March 1987.

10. Preparations for a sampling/analysis program to determine volatile organic emissions from wastewater treatment plants are underway. In co-operation with WTC, Burlington, 4 municipal wastewater treatment plants will be sampled during June/July 1987 and in co-operation with C&P Ontario Region, the Petro Canada, Oakville wastewater treament plant will be sampled in August 1987.

11. Monthly NAPS reports from August 1985 to July 1986 were validated and passed to the Publications Unit.

12. Support was provided to a National Health & Welfare LRTAP study by participating in study design, selection and calibration of sampling equipment and processing particulate samples.

13. A report was prepared summarizing trends in ambient air concentrations of lead, iron, copper, zinc, chromium, manganese, cadmium, nickel and vanadium at sites in Ontario during the years 1969-1985. For many of these metals at many sites, the trend was significantly downward.

14. The final report on the Ontario Oxidants Study was distributed. The report identified a number of follow-on activities/projects which should be addressed to better understand this complex issue.

15. A report on the results of the first year of VOC sampling in Toronto and Montreal was completed and distributed. Measured concentrations of compounds with the potential for adverse health impacts were low at both sites and were similar to concentrations reported from other North American urban areas. Since measured benzene levels at the two sites were similar to those in California, Environment Canada plans additional work aimed at better characterizing Canadian ambient benzene levels and Canadian emission sources.

ENVIRONMENTAL EMERGENCIES TECHNOLOGY DIVISION (EETD)

The EETD is a national focal point and the department's centre of technical expertise on the properties, behaviour, effects, and remedial measures for spills of hazardous materials.

The Division manages the Arctic and Marine Oilspill Program (AMOP) to develop and demonstrate countermeasures for cold-climate marine oil spills. Program updates are provided at the international annual AMOP seminar in Edmonton.

The Chemical Hazards Emergency Countermeasures (CHEC) Program addresses needs for technical information packages for operational personnel, hazard-level monitoring at spill scenes, and the technology for chemical spill cleanup and prevention.

CHEC program updates are provided at the annual Technical Seminar on Chemical Spills. In addition to seminar proceedings and project reports, the Division publishes a quarterly Spill Technology Newsletter.

Highlights

1. In response to an urgent request from the Atlantic Region for on-site assistance to extract pesticides from water collected during the response to an agricultural warehouse fire at Canning, N.S., the laboratory reverse osmosis unit was withdrawn from trials in Toronto and, with a matching capacity activated carbon column, was trucked to Nova Scotia with a crew of 2 summer student employees and 2 contracted operators. Over 95,000 L were processed over 3 weeks at a total cost of about $25,000. All cleaned water contained less than the limit of 4 ppb of pesticide that was imposed by the province. The trials in Toronto (at Shell Canada's Commissioner St. terminal) demonstrated that a 3-stage system using ultrafiltration followed by reverse osmosis and then carbon adsorption can remove 95% of the suspended oil and 80% of all organics from the drainage system water of such facilities. Some 3.5 million litres of leachate from the Gloucester landfill were treated by reverse osmosis followed by carbon adsorption and the combination removed 90% of the organics.

2. The 9th AMOP Technical Seminar in Edmonton 10-12 June was well attended despite the recent major cut-backs by the oil industry (116 versus the 141 that attended in 1985). There were 175 registered attendees at the Technical Seminar on Chemical Spills in Toronto 10-12 February 1987. Although registration was down appreciably from the 310 in Montreal in 1986 and the 234 for the previous one in Toronto, session attendance was actually better.

3. A colour-illustrated non-technical summary report on the BIOS project was published in June. The cost was shared equally by Environment Canada and the Canadian Petroleum Association.

4. A total of 45 people (26 from DOE) attended three courses given to provide refresher training on the use of personal protection equipment and training on the use of portable field analytical equipment developed by EETD.

5. After-hours technical assistance for a chemical emergency was provided to the NEEC and Quebec regional staff by confirming that the OVA and HNU equipment would detect the highly toxic pesticide that was originally thought to have been spilled, and by subsequently confirming the relatively harmless nature of what was spilled.

6. M. Fingas and 3 C&P regional people helped conduct a dispersant trial in the Beaufort Sea to compare zero, single and multiple applications of dispersant. Data analysis has been delayed by equipment problems and the results from this co-funded ESRF study are not expected to be available before September 1987, a slippage of about 6 months. However, all slicks were still visible in CCRS remote sensing imagery obtained 48 hours after the slicks were created.

7. A Memorandum of Understanding between C&P and the U.S. Minerals Management Service (MMS) was signed into effect 9 September and the MMS has contributed a total of $128,000 (U.S.) for two joint projects involving field trials with oil in 1987. One is to test CCG equipment and a procedure for determining whether booms meet performance standards; the other is to assess the effectiveness of two treating agents. The trials date was moved to September because of the weather factor.

8. F. Laperrière helped Japan's IOOET to plan and tank-test the ability of highpressure waterjets to hold oil in the presence of wind, waves and current. A Canadian-manufactured barrier float assembly was provided on loan for the test.

9. K. Meikle presented a paper entitled "Technology Development by Environment Canada for Chemical Spill Response" at Emergency Response '86, a Vancouver conference organized by the Canadian Chemical Producers' Association and jointly sponsored by Transport Canada, Emergency Planning Canada, Expo 86 and Environment Canada.

10. An advisory Telex was sent to C&P HQ, Regional and District offices to advise them that BIO SOLVE, a U.S. dispersant being actively promoted in Canada, had failed the toxicity test for such products. Re-test performed at the request of the importer confirmed the initial finding. Additional tests determined that BIO SOLVE also fails to meet the minimum effectiveness requirement and that the addition of any type of dispersant raises the peak concentration and increases the amount of vapour released by volatile hydrocarbons such as gasoline.

11. K. Meikle attended 2 meetings of the 1987 Oil Spill Conference technical committee in Washington to assist in the selection of abstracts and the review of submitted papers. Both papers submitted by EETD were accepted, as were several papers by Canadian contractors reporting work done for EETD or for the ESRF under EETD's supervision.

12. M. Fingas attended a management meeting at the MacLaren pulp and paper mill in Thurso, P.Q. at the request of a Noranda Group official to advise on ways to improve their preparedness for chemical emergencies.

13. The initial EnviroTIPS series of manuals was completed (50 substances and the Introduction). Eleven manuscript (EE-series) reports and one EPS-series report were produced. All four issues of the Spill Technology Newsletter were published on schedule.

14. In response to a WNR request, a reverse osmosis/granulated activated carbon system was demonstrated at CFB Cold Lake (aircraft washwater), the ESSO gas processing plant at Quirk Creek (process water), and to provincial government officials at both Regina and Winnipeg (pesticide container washwater).

15. A final draft report entitled "Recommendations on Aquatic Biological Tests and Procedures for Environmental Protection, C&P, DOE" was submitted to the Lab Managers Committee for their review.

16. Experiments performed in NRC's Ottawa manoeuvering basin with NOGAP funding showed that oil is fragmented and deposited on the surface of the ice during the freezing process and that subsequent weathering increases the fragmentation and make the oil even less amenable to countermeasures.

17. The prototype acoustic oil-under-ice detector developed cooperatively with ESSO Resources was tested on Beaufort Sea ice in May and performed satisfactorily.

18. The mobile field analytical system was demonstrated at the technical seminar in Toronto in February.

19. The ESRF project to design a mobile burner was completed. Prototype tests showed that stranded oil can be effectively burned off common types of beaches.

ANALYTICAL SERVICES DIVISION (ASD)

The Division has a capability to analyze for a variety of organic and inorganic compounds in diverse sample matrices which usually originate from air pollution-related sources. Analytical method development work is also undertaken to ensure the most appropriate procedures are used for specific sample types.

The inorganic laboratory measures a number of common anions associated with acid rain including sulphates, nitrates, fluoride, bromide and phosphates. Additionally, a multi-element analytical capability exists for toxic metals such as arsenic, lead and mercury.

A Quality Assurance/Quality Control (QA/QC) Section undertakes QA/QC activities both for in-house work and external laboratories including those under contract.

Highlights

1. Over 140 samples from the NITEP/Quebec combustion tests, including stack emissions, process ashes and proof rinses, were analyzed for chlorinated dioxins and furans, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, chlorinated benzenes and chlorinated phenols. The results of this major analytical effort were reported to IPB. Blind duplicate and unknown samples were also analyzed and reported as part of an independent quality control study that formed part of the NITEP monitoring effort.

2. The round robin for PCB in transformer oils was completed and a report printed and distributed to participating laboratories and other interested parties.

3. Emergency analytical support was provided to the Atlantic Regional office in response to a fire which destroyed a warehouse containing pesticide products in Canning, N.S. In our laboratory we analyzed eight vegetation samples for dioxins and furans. Additionally we served as the focal point in coordinating other specialized analyses - about 40 water, vegetation, soil and sediment samples were analyzed for a number of pesticides by Agriculture Canada and a milk sample was analyzed by National Health and Welfare for dioxins and furans. Rapid turn-a-round of the analytical results allowed our Regional office to provide timely and informed recommendations to the Province during the characterization and cleanup of this environmental incident.

4. Other significant analyses provided to assist in characterizing environmental problems causing concern to governments and the public were:

   - four sets of ambient air samples were analyzed for PAH on an emergency basis to delineate the levels of these potentially carcinogenic compounds from the Ottawa Lee's Avenue transitway coal tar spill. Fuel oil and soil samples were analyzed from a second suspected coal tar spill at King Edward Avenue.

   - four space heater oils were analyzed for PCB and confirmational analysis by GC/MS were carried out to confirm the results. The heaters were recalled from the marketplace because of the high levels of PCB (100 ppm) in the oil.

   - four samples of popular fire logs were analyzed for PCB as there was concern that the oil used in making the logs could have been contaminated. No PCB's were detected.

   - five ambient air samples taken in the vicinity of a burn of PCP contaminated woodwastes were analyzed for dioxin/furan at the request of B.C. MOE. No dioxins or furans were found in any of the samples which helped alleviate fears of local residents in the vicinity of the burn site.

- wastewater effluents and algal samples from a proposed NORSK Hydro magnesium refinery were analyzed for chlorinated dioxins/furans. The samples were from an actual refinery and another is proposed for Quebec. Concentrations in a treated effluent were 50-75 times lower than the untreated sample. No dioxins or furans were detected in the algal sample.

- eleven wastewater effluent samples from Northern Wood Preservers were analyzed for chlorinated dioxins/furans, chlorinated benzenes and chlorinated phenols. Significant levels of high molecular weight dioxins/furans (H6-08) and chlorophenols (C14-C15) were measured in some samples.

- special analysis of 66 Hi-Vol filters for lead were reported in support of a monitoring program being developed in Amman, Jordan.

5. The new energy dispersive X-ray spectrometer system for the Inorganic Laboratory was installed and made operational. A multi-element analysis reporting 40 elements on Dichotomous filter samples from the NAPS network is now routinely established in the laboratory.

6. A routine program of analyzing solvent wastes for chlorinated dioxins, furans, and PCBs was undertaken to ensure safe disposal and a safety plan for ASD laboratories was developed and is being implemented.

VEHICLE EMISSION TESTING LABORATORY (VETL)

The VETL conducts the exhaust emission and fuel economy testing of new motor vehicles offered for sale in Canada in the joint Transport Canada/ Environment Canada audit program to determine compliance with standards and regulations in the Motor Vehicle Safety Act.

Environment Canada testing programs to update the Canadian fleet emissions model include in-use vehicle monitoring, the effects of maltuning, removal, maladjustment and tampering of emission controls and the effects of our cold climate.
The VETL provides a unique technical advice and assistance program which includes limited testing for industry such as testing emissions from a new prototype sub-compact car being developed by Bombardier. The program includes evaluation of fuel-saving devices and the provision of assistance to the general public, governments, industries and institutions.

Highlights

1. Of a total of 90 compliance audit vehicles received, failure investigations were carried out on 35 vehicles both 1985 and 1986 models. A total of 133 exhaust emission tests were conducted. With one or two exceptions, vehicles of all manufacturers were involved. One major recall was necessary to replace faulty EGR valves on two models of Volkswagen. In another case General Motors installed improved electronic control modules in the 1986 model Cavaliers to correct a serious pollution problem in the 1985 model. Several important investigations are ongoing.

2. Two major cross-correlation programs were completed during the year. The first in April involved the test laboratories of the Japan Automobile Manufacturers Association (JAMA) located in the USA, EPA, Japan and the VETL. A test vehicle was provided by JAMA and six emission and three evaporative tests were conducted at each laboratory. In the second program the VETL/TC correlation vehicle was tested at General Motors, Ford, Chrysler, and EPA laboratories in January. In both programs, the VETL maintained the high standards expected.

3. The Alternate Fuels Program concentrated on investigating unburned methanol and aldehyde emissions in cold weather from four different blends compared to a reference gasoline. A total of 30 tests were completed. On the test equipment side, sample trains for both methanol and aldehyde collection for the exhaust and evaporative emissions were rebuilt to improve the accuracy of the data.

4. Commencing with the 1988 model vehicles in the Federal Compliance Audit Program, evaporative emissions will have to be monitored. As part of the test to measure hydrocarbon emissions, the fuel must be heated precisely in the vehicle fuel tank. To carry this out, a computerized system designed to handle six vehicles at a time was designed and constructed by the VETL staff and operated successfully in March.

5. Hardware and most of the software phase of the automation of Test Cell No. 1 was completed in March and the first test run was conducted on March 31. This system is unique in North America and will reduce greatly the vast number of test variables and eliminate human error. The contractor is Roy Ball and Associates. VETL staff designed the automation system and designed and built the test bench.

6. Work by contractors on construction of the cold test cell was completed in January. The control room and test bench was done entirely by the VETL staff and completed on January 30. As soon as the system was debugged, the ambient temperature testing phase of the Emission Control Tampering Program and the Aldehyde Monitoring Program was started.

7. The first 1987 model Compliance Audit vehicle was received on November 13, 1986 for the "zero" mile test prior to track testing at the Blainville Test Centre. Except for vehicles under investigation, the 1986 program was completed in August.

8. Technical assistance provided to other agencies included:
   - quality control cross-reference assistance to compressed gas manufacturer - Matheson.
   - calibration, servicing and repair procedure assistance to exhaust gas analyzer manufacturer - Horiba.
   - qualtiy control cross-reference assistance to compressed gas manufacturer - Matheson.
   - calibration, servicing and repair procedure assistance to exhaust gas analyzer manufacturer.

POLLUTION MEASUREMENT DIVISION

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NAPS NETWORK OPERATIONS (1121-95001)

Pollution Measurement Division
Project Manager: P. Brunet (998-4705)

Objective

Co-ordination of the operations of the National Air Pollution Surveillance (NAPS) network for the measurement of ambient air quality in major urban centres and other areas of concern in Canada. Special ambient air measurement studies are designed and implemented as required.

Relevance

Information on fluctuating ambient air levels of contaminants is essential for the identification and assessment of air pollution problems as well as for the development and evaluation of the effectiveness of control strategies.

Work Plan

(i) Co-ordinate the follow up to the Federal/Provincial NAPS Annual Technical Meeting
(ii) Assist provinces in the operation and maintenance of NAPS stations
(iii) Operate two NCR stations
(iv) Procure and distribute 25 replacement analyzers
(v) Verify and distribute 200 cylinders of zero and span gases to provincial agencies
(vi) Train 8 provincial operators on NAPS instrumentation
(vii) Process 8000 filters for quantification of suspended particulates
(viii) Carry out maintenance and repair of 40 monitors at EPS HQ laboratory
(ix) Operate and update equipment inventory and site documentation data base systems
(x) Compile annual performance statistics on 450 air monitors

Status Report - March 31, 1987

1. Technical assistance in the operation and maintenance of NAPS stations across Canada was provided to provincial and municipal co-operating agencies in trouble-shooting problems with network analyzers, providing replacement parts, providing consumables and maintenance kits; repairing instruments and calibrating equipment and peripherals.

2. Compressed gas calibration standards and zero air for carbon monoxide and nitric oxide analyzers and permeation sources for sulphur dioxide were certified and supplied to NAPS provincial and municipal co-operating agencies. A number of gaseous and particulate monitoring instruments were calibrated in the lab.

Since the quality and the reliability of the gases from our suppliers have improved over the years, some changes to the practice of supplying zero and span gases were proposed to the NAPS agencies. Pending the agencies favourable response, zero and CO span gases would be purchased by the agencies.

3. In support of the measurement of suspended particulates, inhalable particulates, lead, sulphate and nitrate, sample filters were supplied to a number of NAPS agencies. These filters include those from regular hi-volume samplers, size selective inlet samplers and dichotomous samplers. Exposed filters from January to November 1986 have been processed and forwarded to Analytical Services Division for chemical analysis. Dichotomous samplers are continuously being overhauled, calibrated and exchanged to ensure proper functioning. Multi-element data for 112 dichotomous filter samples was received from Analytical Services Division.

4. Following various discussions with Transport Canada, a letter to the Ministry was drafted to inform officials of our Section's procedures and practices of handling and shipping dangerous goods. After a visit to the Calibration Laboratory, a meeting was held with Mr. K. Kendeall, Advisor, Standards and Certifications, Regulations Branch of Transportation of Dangerous Goods, Transport Canada. A certificate from Transport Canada exempting PMD and subsequently NAPS agencies from specific sections of the new regulations of the Transportation of Dangerous Goods Act is in abeyance. A follow-up letter to our original request was sent to Transport Canada.

5. The upgrading of 12 ozone analyzers was completed by Dasibi Environmental Corporation. These analyzers were verified and returned to the respective NAPS agencies.

6. Both Ottawa-Hull stations were calibrated using the Dasibi 1009 PC calibrator for the first time in the field. An automatic zero and span calibration system was installed at the Ottawa Station. A second calibration of all analyzers was performed and a report was prepared. A new SO2 analyzer was calibrated and installed at the Hull station as part of the NAPS replacement program.

7. The instrumentation used for analyzing zero and span cylinders was relocated from the calibration laboratory to the Operations and Maintenance area. The instrumentation used for Acceptance Testing of NAPS analyzers was moved to the Operations and Maintenance laboratory.

8. A zero air system for the TECO 49 ozone analyzer was designed and tested. A microprocessor controlled timer system replacing the standard mechanical timer of the ML8850 SO2 analyzer was tested. A description of and procedures for the systems were written for publication in the NAPS newsletter.

9. Phase I of the Site Documentation has been updated and typed. All sections, except section B of both Phase I and II of the site documentation were sent to the Publication Section. Section B will be sent shortly.

10. At the request of the GVRD, T. Dann participated in a task force review of the Lower Mainland air quality monitoring network. An on-site survey of all the monitoring stations was made and a report prepared in consultation with other task force members.

11. A telephone line and a data acquisition system were installed at the Hull station. A comparison of the data from the logger and the recorder charts will be carried out.

NAPS NETWORK - DATA PROCESSING (1121-95002)

Pollution Measurement Division
Project Manager: P. Brunet (998-4705)

Objective

Process and validate data on ambient air quality in major urban centres and other areas of concern in Canada through the operation of the National Air Pollution Surveillance (NAPS) network. Disseminate and provide interpretation of NAPS data as required.

Relevance

Information on fluctuating ambient air levels of contaminants is essential for the identification and assessment of air pollution problems as well as for the development and evaluation of the effectiveness of control strategies.

Work Plan

(i) Compile, validate and publish 12 monthly data summaries
(ii) Compile, validate and publish 1 annual sumary
(iii) Compile, validate and publish various (10) special data reports
(iv) Maintain and update restructured NAPS data base.
(v) Implement changes improving data transmissions procedures:
- Quebec - from magnetic tapes to micro via modem
- Alberta and Saskatchewan - from diskettes to micro via modem
- Atlantic Provinces - from cards to micro via modem

(vi) Digitize chart records from Whitehorse, Ottawa-Hull station and ozone network in Quebec Region.

Status Report - March 31, 1987

1. NAPS network air quality data were collected and processed for publication. Monthly NAPS reports from August 1985 to July 1986 have been validated and sent for publication. The ten ppb limit for SO2 in the monthly reports and the annual summary will be replaced by the actual concentration values.

2. The NAPS data base has been transferred to the Atmospheric Environment Service (AES) computer from the Crowntek computer. The contractor continued work on the system using an account at AES. All contract deliverables have been completed except for acceptance testing. A meeting was held with SID and AES to discuss future operation of the data base at AES. The terms of a contract to determine the feasibility of completing and operating the NAPS data base at AES have been written; however, the contract implementation will be delayed until next fiscal year. The completed User's Guide with documentation has been received and is being reviewed.

3. Air monitoring data from recorder strip charts, for the Ottawa-Hull station (updated to the end of February 1987) were digitized.

4. CO and NO2 data from the Whitehorse, Yukon winter-time study are being processed.

5. COH tapes from Victoria, Prince George, Whitehorse, Ottawa and Hull to February 1987 are being processed.

6. Information on a NAPS update format was sent to Atlantic Region, Quebec and Manitoba.

7. A listing of 1985 hi-volume lead data was sent to New Brunswick and Vancouver.

8. Selected air pollution data (1975-1984) was submitted to the Organization for Economic Co-Operation and Development (OECD).

9. Information on the new NAPS data base was prepared for the FPACAQ committee meeting.

10. A review of the air quality trends report, prepared by the Inventory Management Division, was carried out.

11. Air pollution data for 1985 were sent to the World Health Organization.

12. Selected air pollution data for 1985 were sent to Statistics Canada.

13. Ozone data (April to August 1986) from Ste-Etienne, Quebec have been processed. Results were sent to C&P, Quebec Region.

14. A listing of Norman Wells, N.W.T. particulate data was sent to Ed Collins C&P, Yellowknife.

15. Air quality data annual and trend reports were sent to the University of London, England.

16. An ozone data summary for Eastern Canada for the period 1976 to 1985 was sent to Ron Pearson, Ontario Ministry of the Environment.

NAPS QUALITY ASSURANCE PROGRAM (1121-95003)

Pollution Measurement Division
Project Manager: P. Brunet (998-4705)

Objective

Co-ordinate the development and implementation of a comprehensive quality assurance program for the National Air Pollution Surveillance (NAPS) Network.

Relevance

Important and far-reaching decisions may be based on air quality data. It may be used to determine attainment of air quality standards, the feasibility of plant expansions or process changes, the necessity of air pollution control device installation, the future growth of industrial areas, and could serve as evidence in courts of law. With current emphasis on legal action and social pressures to abate pollution, it is essential that air quality data accurately represent pollutant concentrations.

Work Plan

(i) Review and update Quality Assurance program as required and revise quality assurance procedures.
(ii) Continue visits to co-operating agencies (6 field trips) to review operations, discuss program changes and provide on-site assistance where required.
(iii) Carry out 3 instrument evaluation and 25 acceptance tests on NAPS replacement monitors.
(iv) Conduct 4 inter-laboratory tests and provide training to all NAPS operating agencies, as required.
(v) Provide assistance to agency quality control activities especially in the area of instrument calibration (all agencies).

Status Report - March 31, 1987

1. In support of the NAPS instrument replacement program, the following analyzers were verified and sent to NAPS agencies:

3 ML 8840 NOx analyzers
9 TECO 48 CO analyzers
16 ML 8850 SO2 analyzers
2 TECO 43 O3 analyzers

Several hydrocarbon cutters for ML8850 SO2 analyzers were tested and found suitable for replacement of existing scrubbers. Several optical windows of the ML 8840 NOx analyzers were found defective as a result of a design weakness. The manufacturer will replace the cells at no cost. One TECO48 CO analyzer failed tests due to a defective detector.

2. Field testing of the Dasibi 1009PC calibrator was completed at both Ottawa-Hull stations with satisfactory results. Six Dasibi 1009PC calibrators were ordered for replacement of the older Bendix portable calibrators. Ten portable clean air systems for use with the calibrators were constructed. Two of the six Dasibi calibrators ordered were received and tested in the laboratory. These calibrators are replacements to the original 1009 and are designated model 5009. Microprocessor technology allows for the provision of temperature and pressure compensation and automatic diagnostic routines. Initial testing of the units indicates positive results.

3. Calibration audits were completed at the Regina Class I NAPS station, the Winnipeg Class I station and at a station operated by Health & Welfare Canada in Yorkton, Saskatchewan. A special concurrent calibration audit was completed at the Ottawa Wurtemburg station operated by Ontario Ministry of the Environment. Reports on these audits were prepared.

4. The procedures for a proposed round-robin testing program were sent to NAPS agencies for review and approval. This program will serve to evaluate and improve accuracy and precision of NAPS data. Several analyses of the test gases revealed decreases of concentration in the sub-ppm SO2 and NO cylinders. Quick cylinder turn-arounds and reanalysis will be essential for meaningful results. All agencies replied favourably to the program which began at the end of March 1987.

5. The calibration laboratory was shut down for two weeks following water damage to four ozone calibration standards. Three ozone calibration standards are still responding erratically. Ozone and NO2 calibration work (using gas phase titration) are affected. A primary calibration of the units cannot be effected before the problems with the units are resolved.

6. Following a request from MENVIQ (Environment Quebec), a NOx analyzer was calibrated and loaned for a short period in support of a special indoor sampling study in Ville Laval.

7. A draft copy of a NAPS quality assurance manual containing selected procedures and recommendations currently used by various NAPS agencies and procedures written by PMD was prepared and will be distributed to NAPS agencies for review.

SPECIAL AMBIENT AIR MONITORING SURVEYS (1122-95004)

Pollution Measurement Division
Project Manager: P. Brunet (998-4705)

Objective

Assist C&P Regional Offices and provincial agencies in the identification, characterization and assessment of local and regional air pollution problems.

Relevance

Local jurisdictions do not always have the necessary equipment and expertise to assess rapidly emerging air pollution problems. C&P is regarded as a source of support in such instances.

Work Plan

(i) Provision of advice and equipment for Cornwall Island fluoride monitoring (C&P Ontario).
(ii) Advice re pesticide, dioxin and PCB ambient monitoring (IPB).
(iii) Assistance re monitoring to document health effects of LRTAP pollutants (H&W Canada).
(iv) Advice and assistance to C&P Regional offices, as required.

Status Report - March 31, 1987

1. Following a request from the Ontario Ministry of Environment, ambient air measurements of polycyclic aromatic hydrocarbons (PAH) were carried out at Ecole Notre Dames des Champs on Navan Road and inside Lees Avenue transitway station in Ottawa in the vicinity of a coal tar cleanup operation. A report was prepared and distributed.

2. Size-selective hi-vol filters are being processed for TSP, Pb, SO4 and NO3, from a National Health & Welfare (H&W), LRTAP study. A hi-vol calibration device was referenced to a flow standard in the calibration laboratory in support of the study. Discussions were held with Health and Welfare re support to the program in 1987/88.

3. Filters from the GVRD SO4/NO3 epidemiological study continue to be processed. Sampling at the relocated Kitsilano station was initiated.

4. Assistance on aromatics and ketone sampling was provided to the Source Measurement Section for the Montreal paint factory survey. A summary of analytical results was prepared.

EVALUATION & DEVELOPMENT OF AMBIENT AIR MEASUREMENT TECHNOLOGY (1324-95005)

Pollution Measurement Division
Project Manager: T. Dann (998-4705)

Objective

To develop and evaluate new ambient air pollutant measurement technology to support the NAPS network and Toxics and LRTAP issues. To phase in developed technology into the NAPS network as required.

Relevance

Because of the ever increasing list of air contaminants of concern, it is vital that effort be expended on development of ambient air measurement methods and on keeping up with developments in the field of air pollution monitoring technology. Efforts to develop and evaluate measurement methods for fine particulates and organic air pollutants have been undertaken in recognition of their priority in the Toxics and LRTAP issues.

Work Plan

(i) Measurement and reporting of VOC concentrations at three sites (Toronto, Montreal, Vancouver) and PAH at two sites.
(ii) Measurement of oxidant precursor compounds in Vancouver during summer of 1986 in support of BC MOE studies.
(iii) Development and application of standard reference method for H2S.
(iv) Advance the development of ambient air measurement methods for aldehydes, PCB, dioxin/furan.
(v) Application of receptor modelling for collected multi-element data sets for 13 sites in Canada.
(vi) Evaluation and provision of advice on selection and application of monitoring, calibration and data acquisition technology.

Status Report - March 31, 1987

1. Acceptance testing of two new VOC samplers with dual independent flow control was completed. One unit was installed at the Junction Triangle station and the other one was installed at the Breadalbane NAPS station.

2. A presentation on ozone formation and control was delivered at the Environmental Law Research Foundation Conference "Beyond Acid Rain".

3. A report summarizing sulphate, nitrate and lead data from the IP monitoring program for the period May 1984 to April 1985 was prepared and distributed.

4. VOC and PAH sample collection and analysis from Junction Triangle, Toronto and Pointe aux Trembles, Montreal was terminated in October. A new VOC sampler was installed at Breadalbane St., Toronto; this site is now the only Toronto site since sampling at Junction Triangle was terminated in October. VOC sampling is also continuing at Rocky Point Park, Port Moody (Vancouver).

5. A total non-methane organic (NMOC) sampling system using evacuated passivated stainless steel canisters was tested in Vancouver. One sampling unit was installed at the Robson Square station and another one was installed at the Rocky Point NAPS station. The data will be used to support a BC MOE/GVRD ozone control strategy under development.

6. A presentation on air quality concerns and the potential implication of alternative fuel use in the transportation sector was presented at the Alternative Fuels Symposium held in Ottawa.

7. The final report on the Ontario Oxidants study was distributed.

8. An extended abstract outlining results of the Ville LaSalle waste dump VOC monitoring effort of 1986 was prepared. An invitation was received to present these results at the American Chemical Society National Meeting, September 1986. A complete paper was prepared for submission to APCA.

9. A report on the results of the first year of VOC sampling in Toronto and Montreal was completed and distributed.

10. A contract for organic monitoring and analysis support was issued to Wang Environmental Consultants Ltd. Their contract will provide support to PMD source and ambient organic monitoring development efforts and to VETL in support of methanol/aldehyde measurements from methanol fuelled vehicles.

11. A symposium on urban air tropospheric air pollution concerns was attended at York University.

12. A letter of support was prepared re an NSERC Application to Dr. Ormrod University of Guelph on ozone effects on vegetation. A number of other NSERC proposals were reviewed.

13. The APCA Annual conference and the EPA/APCA Symposium on Measurement of Toxic Air Pollutants were attended.

14. EPPD meetings on Air Toxics and Oxidants were attended. A meeting on ambient benzene levels was also attended; a report will be prepared.

15. Discussions were held with C&P Ontario Region on VOC sampling from industrial waste water treatment plants in support of the Ontario MISA program. A meeting with C&P Ontario and Petro-Canada representatives was attended and the Petro-Canada refinery site was visited to determine suitable sampling locations. Discussions were held with WTC re provision of assistance to their program to evaluate VOC emissions from municipal wastewater treatment plants.

16. A presentation on source characterization and source control was made at the Environment Canada "Science and Policy Forum on Toxic Rain" hosted by NWRI in Burlington.

17. A report summarizing ambient air PAH data collected in Toronto and Montreal is in preparation.

18. T. Dann was appointed to the CCREM Working Group on monitoring of airborne substances. A report was completed by the group and forwarded to the parent committee.

19. A report was prepared summarizing trends in ambient air concentrations of lead, iron, copper, zinc, chromium, manganese, cadmium, nickel and vanadium at sites in Ontario during the years 1969-1985.

20. The two PAH samplers on loan to MOE Central Region were returned after the end of the coal tar cleanup survey and were reconditioned.

21. A meeting was attended at AES, Downsview to discuss the merits of a UP on passive monitoring for trace organics.

22. Discussions were held with the Ontario Ministry of the Environment in relation to a project designed to compare manual NMOC sampling techniques with continuous monitors. A sampling program will be carried out during the summer of 1987.

23. A contract for the fabrication of parts to be used on six modified hi-volume samplers for PAH sampling was prepared.

24. Three VOC duplicate samplers were overhauled and re-conditioned for use in the survey program for this summer.

25. A new PAH canister with XAD resin added to the polyurethane foam plugs was tested.

26. A detailed report outlining ambient benzene concentrations in Canada, emission trends and potential control measures was prepared and sent for internal review.

27. A meeting of an ad-hoc committee formed to evaluate air quality impacts of the Detroit incinerator was attended. Discussions were held with C&P Ontario Region and Ontario Ministry of the Environment regarding the establishment of monitoring programs for volatile and semi-volatile organics and metallic elements in the Windsor area.

28. A North American symposium on photochemical oxidants was attended in Quebec City.

DEVELOPMENT OF STACK SAMPLING TECHNOLOGY (2331-95007)

Pollution Measurement Division
Project Manager: R.B. McCaig (998-4772)

Objective

To revise/update existing C&P emission measurement methods to reflect changes in the art in both equipment and knowledge. To evaluate commercially available monitors capable of measuring stack emissions on a real-time basis. To attend training sessions and related conferences and to participate in technology transfer exercises.

Relevance

Standard reference methods are incorporated into national emission regulations/guidelines and specify the emission measurement procedures which shall be used to determine compliance. Continuous measurement systems provide emission data to control agencies over and above that required for compliance monitoring.

Work Plan

(i) To prepare manual sampling protocols in support of Quebec City NITEP Combustion Phase by December 31, 1986.

(ii) Develop system and perform continuous source emission survey during Quebec City Combustion Phase in support of a real-time monitoring program to control emission levels by process control.

(iii) To perform simultaneous sampling to establish precision of the organic sampling method and report the results by March 31, 1987.

Status Report - March 31, 1987

1. Manual sampling protocols were prepared and supplied to Lavalin in support of the Quebec City Municipal Incinerator NITEP Combustion evaluation phase.

2. A combustion gas monitoring system with 9 continuous analyzers was built and installed at the Quebec Incinerator in late April. This system generated real-time data during the characterization phase, May 1 to 12, 1986 and again during the performance testing phase, June 26 to July 12, 1986. Stack gas parameters measured included: temperature, CO, CO2, O2, THC, HCl, NOx, SO2 and total particulate.

3. The Lavalin Characterization Test report was reviewed and comments forwarded to the Industrial Programs Branch (IPB).

4. A meeting was held at RRETC with R. Capowski regarding proposed changes to the lead from secondary lead smelters regulation.

5. Major revisions to the standard particulate method are underway. To date, the calibration procedures and the particulate sampling procedures have been revised. Revision of the other sections (eg. sampling site selection, minimum traverse points, molecular weight determination) is advancing and will be incorporated under one cover when available.

6. The site chosen to compare two PCB sample collection methods in September was not suitable. Instead, field tests were carried out at another source to establish the precision of a proposed PAH collection method. Preliminary analytical results indicate that the PAH levels are very low. An air emission report on the source is being prepared for IPB. The results of the PAH precision study will be reported seperately in a PMD internal report when time permits.

7. The suitability of a new glass liner assembly to reduce the possibility of contamination during organic sampling was confirmed by field trials at the Duffin Creek sewage incinerator.

8. A three dimensional flow measuring device based on a NRC design was constructed. The proto-type probe will be tested for its capability to measure cyclonic flow in flues and stacks.

9. Laboratory apparatus has been assembled to generate small quantities of stack gases representative of a combustion source. Initital tests on water vapour recovery using concentrated H_2SO_4 as the drying agent have been carried out. The next step is to compare this procedure to commercial dryers such as permeation devices. The objective of this project is to recommend a method to condition stack gases for the reliable continuous emission monitoring of HCl.

10. A manual specific for determining the concenteration of hydrogen chloride emissions from incinerators has been written and is with the typist.

11. At the request of the Industrial Programs Branch, a meeting was attended with the CEA Trace Contaminants Steering Committee to discuss R&D needs related to emission characterization at thermal power plants.

12. The standard reference method for NOx emissions from combustion sources which utilizes procedures first proposed by ASTM is accurate, but less than desirable. It uses evacuated flasks and collects samples over very short intervals, ie. 20 seconds. The analytical procedure demands overnight sample contact with the collection reagent in the flask. In order to establish any kind of a time average, an inordinate number of evacuated flaks is needed. EPA has promulgated an alternative procedure based on an impinger system to circumvent this difficulty. We can see the merit in the new procedure and are procuring the necessary equipment to compare both procedures in the laboratory. Depending on the outcome, field trials at a combustion source some time in the new year may be necessary.

SOURCE EMISSION EVALUATIONS (2636-95008)

Pollution Measurement Division
Project Manager: R.B. McCaig (998-4772)

Objective

To measure emissions from stationary sources to satisfy data requirements for C&P responsibility centres and other clients.

Relevance

C&P is responsible for specifying regulations limiting the emission of hazardous substances and for guidelines limiting other contaminants. Periodically, it becomes necessary to measure emissions to assess their impact and the effectiveness of control measures.

Measure and report on emissions of specific contaminants from an estimated 4 stationary sources at the request of C&P responsibility centres and other clients. Potential sources to be evaluated include:

Work Plan

(i) Hamilton-Wentworth sewage sludge incinerator
(ii) Waste wood fired heating systems
(iii) Paint and varnish plants
(iv) Pulp and paper plants
(v) Secondary lead smelters

Status Report - March 31, 1987

1. A preliminary report summarizing the total particulate measurements made at the FBC unit at CFB Summerside was distributed to EM&R and IPB. Completion of this work is pending receipt of process data from EM&R.

2. The source evaluation program at the Hamilton-Wentworth Sewage Treatment Plant incinerator has been postponed indefinitely due to plant operational problems. As a substitute, the MOE Duffin Creek facility was visited in late September and early October. Samples were collected for total particulate, metals, PAH, Dioxin/Furan, PCB, CB and CP analyses. The stack gas concentrations of NOx, SO2, CO2, CO, O2 and THC were also measured. Additional single point samples were collected for determining the precision of the proposed PAH method.

   To date, preliminary results on total particulate, CO2, O2, SO2, NOx and THC have been forwarded to IPB. An analytical report on the organics was received from Zenon in January. The inorganic analytical report from Barringer was received on March 12, 1987. These data are being reduced and a final report is being prepared.

3. The possibility of measuring lead emissions from two secondary lead smelters in Montreal was discussed with D. Pilon. No official request was received.

4. A request to measure the air emissions from a woodfired boiler at the Montague Hospital in P.E.I. was received. Operating and emission guidelines for this combustion process are being considered by the Atlantic Regional Office.

5. The SICO and Sinclair-Valentine paint and varnish plants were visited in November to measure volatile organic air emissions. Two sampling techniques were employed to quantify the emissions of acetone, methyl ethyl ketone, methyl isobutyl ketone, xylene, toluene, benzene, simple alphatic hydrocarbons and volatile chlorinated hydrocarbon. Sample analytical results have been received and a report is being prepared.

AIR POLLUTION CONTROL TECHNOLOGY DEVELOPMENT & ASSESSMENT (2434-95009)

Pollution Measurement Division
Project Manager: R.B. McCaig (998-4772)

Objective

Assist in the assessment of air pollution control technology through comprehensive emissions and process monitoring and interpretation of results.

Relevance

C&P is required to identify and assess control technology that may be able to prevent or reduce the release of pollutants to the environment. Technical advice on control options is required for regulation development and codes of good practice.

Work Plan

(i) Characterize emissions from and evaluate effectiveness of control devices for Quebec City incinerator (re NITEP Program) (Spring 1986)
(ii) Evaluate the effectiveness of burner modification and limestone injection technique to reduce emissions from Boundary Dam Thermal Power Generating Station (Summer 1986)
(iii) Characterize emissions from CFB Heating Plant (LIMB) at CFB Gagetown. (December 1986)
(iv) Characterize emissions from Summerside CFB Heating Plant (FBC process) when fueled with wood pellets/coal. (Fall 1986).
(v) Characterize emissions from Charlottetown Thermal Power Plant (coal/water mixture as fuel). (Summer 1986)
(vi) Characterize emissions from Chatham FBC Thermal Power Plant (20 MW converted) (February 1987).

Status Report - March 31, 1987

1. The sampling portion of the Flakt Vol. I report was re-written and sent to UAD. Additionally, other sections were reviewed and comments forwarded.

   Raw data summaries on organics, mercury and HCl were supplied to Flakt for inclusion in Vol. IV.

Flakt's contribution to Volume II (Section 3) was reviewed and edited. Comments were forwarded to IPB.

The PMD's contribution to the Flakt Volume II report was completed as an internal report and forwarded to IBP.

The PMD's contribution to Volume III has been completed but is being held pending release of the ASD's analytical protocol.

The PMD's commitment to measure O2, CO2, CO, SO2, NOx, THC and HCl during the Quebec City incinerator/Lavalin study on a real time basis, was met.

Comments on Lavalin's proposed technique for correcting the high blank residues on the probe wash were completed.

A meeting was attended in Toronto with Lavalin to help resolve some difficulties with the refuse sample analysis.

A proposed format for NITEP reports was completed and forwarded to IPB. This format was recomended to eliminate the unnecessary delays in the present report structure.

Volume III for the Flakt program was completed and distributed internally for editing.

An in-house report describing all sampling aspects of the Flakt program was drafted.

Quality assurance information on the continuous monitoring system utilized during NITEP II testing was forwarded to Concord Scientific. Data included system recoveries, calibration gas information and a short description of the test procedures for linearity, reproducibility, zero/span drift and speed of response.

A report describing the equipment and procedures outlined during NITEP II in Quebec City is being prepared. The document will form part of the overall testing report being prepared by Lavalin.

2. P.K. Leung visited Raleigh, N.C. to discuss LIMB and FBC projects with EPA officials.

3. With respect to evaluating the effectiveness of burner modifications and limestone injection techniques to reduce SO2 and NOx emissions from Boundary Dam, the PMD visited the site and assisted Saskpower and CEA establish their monitoring systems. See review of project under Scientific and Technical Advice (1223-95011), item no. 1.

4. A source characterization study outline by G. Ternan, Atlantic Region for the CWF Maritime Electric demonstration program in Charlottetown has been accepted. A survey proposal to measure air emissions, characterize solid wastes and to measure baghouse collection efficiencies has been prepared. Also during this survey, the emissions from a wood-fired boiler at the Montague Hospital are to be measured. Originally scheduled for November 17, 1986, the program has been postponed due to operational problems with the CWF unit.

5. CFB Gagetown, Oromocto, N.B. was visited in late February and early March on behalf of the Oil, Gas and Energy Division of IPB. A total of 19 particulate runs were completed under various burner operating conditions, ie. coal type, Ca/S ratio and boiler load. Continuous monitoring for NOx, SO2, THC, CO2, CO and O2 was carried out concurrently with the particulate tests. Solid samples from various process streams were also collected on behalf of IPB; their disposition must still be discussed.

DEVELOPMENT OF HAZARDOUS WASTE INCINERATION TECHNOLOGIES (2433-95010)

Pollution Measurement Division
Project Manager: R.B. McCaig (998-4772)

Objective

To complete the setting up, evaluation and testing of the System for Thermal Decomposition Studies (STDS) apparatus and to generate thermal decomposition profiles for a variety of toxic chemicals.

Relevance

Data on thermal decomposition profiles, products of incomplete combustion and residuals are needed to support incineration as a viable control option. Laboratory studies are the first step in the generation of these supporting data.

Work Plan

Generation of thermal decomposition profiles for waste materials and various substances slated for disposal. Candidate substances/chemicals scheduled for 1986/87 (timing and scheduling of work uncertain and subject to availability of materials, changing priorities and the co-operation of others):

Pesticides
Herbicides
Incinerator Ashes
Sydney Tar Pond materials
Potential PCP substitutes

Status Report - March 31, 1987

1. Analyses of herbicide residue samples from the Saskatchewan Research Council using the STDS were completed. A draft report was prepared and forwarded to the Western and Northern Region district office in Regina in January. Comments are being entertained and a final report is being prepared.

2. The Sydney tar pond sediment samples have been analyzed using the STDS. A report on the thermal destruction of these samples was prepared and forwarded to the Atlantic Regional office in March 1987.

3. R.B. McCaig attended a meeting in Cincinnati to discuss STDS activities with W. Ruby and B. Dellinger (University of Dayton); R. Mournighan (EPA); M. Wilson (Alberta Research Centre) and M. Antonic (Wastewater Technology Centre).

4. Compound identification capabilities of the STDS has been enhanced by installing an EC detector. An IBM PC-based data logging and system control unit has also been received.

5. F. D'Addario attended the Joint US/Canada Hazardous Waste Incineration Research Meeting in Dayton, Ohio on September 23, 1986.

6. A document outlining the STDS project to date was drafted and sent to selected audiences for comments.

7. An outline of a proposal to study the formation of PCDD's and PCDF's in the heat recovery unit of MSW incinerators was drawn up. The purpose of the document was to stimulate dicussion on the topic.

SCIENTIFIC AND TECHNICAL ADVICE (1223-95011)

Pollution Measurement Division
Project Manager: D.A. Williams (998-4130)

Objective

To provide advice on the measurement and assessment of air pollution in ambient air and as emitted from stationary sources.

Relevance

Dissemination of knowledge necessary for the identification, characterization and assessment of air pollution problems in Canada.

Work Plan

(i) Maintain expertise in areas of source and ambient air pollution measurement, assessment and control, especially related to Toxic and LRTAP priority contaminants and provide assistance and advice as required.

(ii) Maintain up-to-date knowledge in area of photochemical oxidants and provide advice and assistance as required.

(iii) Review Unsolicited Proposals and other proposals, projects and programs requiring assessment by Environment Canada.

Status Report - March 31, 1987

1. At the request of IPB and in co-operation with SASKPOWER, EM&R and the Canadian Electrical Association, PMD representatives visited the Boundary Dam coal-fired power plant at Estevan, Saskatchewan. The two continuous flue gas monitoring systems operated by SASKPOWER and Combustion Engineering were evaluated and possible causes of the discrepancies in their results were discussed. A two-prong sampling effort was carried out: one aimed at determining the suitability of the testing locations and the other at the acceptability of the calibration/sampling procedures. The test results from the simultaneous multi-point traversing of the two flue systems showed that gas stratification and process change had minimal biasing effect on the data and that with proper calibration and sampling procedures, the two systems should yield comparable results. A memo detailing PMD's comments and recommendations was sent to all the parties concerned.

2. Copies of the Royal Jubilee Hospital report were sent to:

   Herbert Hollander - STV/Sanders and Thomas
   Brenda Allen - ERT Inc.
   Wilfred Ng - MOE
   L.Y. Lee - Hatch Associates
   Ron Dickson - Radian Corporation
   Gloria Lindner - BF Goodrich
   Patricia Hanlon - California Air Resources Branch
   Milton Beychok - a private consultant
   Marie Jetter - Alberta Environment
   Gary Wong - Ontario Ministry of the Environment

3. A copy of the 1983 Hamilton-Wentworth Sewage Sludge Incinerator Report was sent to Tony Ho, MOE.

4. Technical advice was given to:

   (a) G. Lee, EM&R, on sampling for SO2 in a 1200°C flame,

   (b) H. Teh, Noranda Research, on particle sizing,

   (c) Pat Foody, Iotech Corp. Ltd., regarding recommended sampling methods for organics and SO2, and

   (d) Inventory Management Division regarding the partitioning of lead in non-ferrous smelter flue gases.

5. The SYSCO steel mill in Sydney, N.S. was visited in 1986 to review their practice of burning coal tar, a toxic by-product of the coke oven operation, in an open hearth. From an environmental effects aspect, this practice was deemed unacceptable. SYSCO was so advised by the Atlantic Region. Since then, SYSCO has retrofitted one of the furances to incinerate coal tar and is applying for an air permit. The mill was revisited in February 1987 to provide technical advice on organic sampling methodologies to the representatives of Sydney Steel

Corporation (SYSCO), C&P's Atlantic Regional office and the Nova Scotia Department of the Environment. Again, the expertise of the PMD was required by the participating parties to address the concern of toxic organic emissions from this uncontrolled source.

6. Technical assistance was provided to AES personnel regarding the operation, maintenance and calibration of Ozone analyzers. One Ozone analyzer was calibrated and sent to AES.

7. Technical advice was provided to Health and Welfare Canada personnel regarding dichotomous samplers in Saskatchewan and M.O.E. personnel regarding dichotomous filters.

8. In support of the IDRC/Jordan project, P. Brunet traveled to Amman, Jordan to provide technical assistance and advice regarding the implementation of an air monitoring network in Amman. A trip report with various recommendations on the project was completed. Follow-up action to various requests was provided.

9. Input was provided to the 85/86 Clean Air Act Annual Report and the 1985 Trends Report.

10. Mr. Moore Moffatt from Bottswana visited RRETC laboratories and was informed about activities in the Ambient and Source Measurement Sections of PMD.

11. At the request of C&P, Quebec Region, a meeting of the "Groupe d'échange scientifique sur les oxydants au Québec" was attended and a brief presentation on a technical evaluation of current ozone analyzers was given.

12. Technical advice on the sampling and monitoring of ozone was provided to Ministère de l'Energie et Resources, Gouvernement du Québec.

13. Advice on the use of various detectors for GC analysis of sulphur compounds emitted by pulp and paper operations was given to the Pacific Regional office (D. Poon).

14. Technical advice regarding the basics of organics sampling was sent to Mr. Howie Matza of Greenpeace.

15. Technical advice regarding the emissions from non-ferrous smelters was sent to Reggie Furlotte of Brunswick Mining and Smelting and Noel Billette of EM&R.

16. Copies of stack testing methods used during the NITEP/Quebec City survey were sent to Alberta Environment (via Danny Woo of the W&N Region) and Mr. Don Hannah of the Department of Science and Indstrial Research, New Zealand.

17. Technical advice on the sampling of stacks with cyclonic flow patterns was given to Mr. Kbhattacharyya of the BC Ministry of the Environment.

18. A meeting was held with Mr. Murray Brooksbank of the Ontario regional office and Mr. Garry Wong of the Ontario Ministry of the Environment to discuss the trial burns at the Occidental Chemical Incinerator in Niagara Falls, N.Y. The stack tests associated with the trial burns were witnessed by two PMD representatives in October and November 1986. Trip reports were prepared and forwarded to the Ontario region.

19. An EPA/EC workshop on energy from MSW incineration was attended in Durham, N.C. U.S.A.

GENERAL

1. Following Mr. Simm's resignation, a contract to fulfill the position duties was written and tendered.

2. Mr. J. Shelton continues to carry-out the duties of Supervisor, NAPS Data Publications, a position he has been acting in since March 1983.

3. Mr. M.J. Bumbaco continues to function as the Chief of the Analytical Services Division, an acting position he has held since January 1984.

4. Messrs. P. Bradt, C. Gilbert, and R. Yeatman's Position Assessment Schedules were updated. Mr. R. Yeatman's PAS was submitted to Personnel for classification.

5. Four short term (January to March 31, 1987) positions within the Division were staffed.

6. Interviews to hire Co-op students were conducted.

7. P. Brunet attended the Employee Asistance Program Workshop.

8. A review of PMD's word processing needs was carried out and a detailed evaluation of existing technology resulted in the selection of a Xerox 6085 system.

ENVIRONMENTAL EMERGENCIES TECHNOLOGY DIVISION

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LIAISON WITH CLIENTS (4239-96001)

Environmental Emergencies Technology Division
Project Manager: K. Meikle (613-998-9622)

Objectives

1. To provide specialist technical advice and assistance on request.

2. To promulgate research and development results effectively.

3. To identify departmental and national technology development needs pertaining to spill countermeasures and establish priorities.

4. To plan work and manage resources effectively.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Respond to requests for technical advice and assistance as required, including:

(a) provision of the division's detection, sampling, analytical and cleanup equipment; and,
(b) technical reviews of the spill countermeasures aspects of draft publications and of oilwell drilling and other proposals having the potential for significant spills.

Task 2 - Report progress and the results of completed studies as expeditiously as possible, including:

(a) producing technically reviewed project reports;
(b) convening the 9th AMOP Technical Seminar in June 1986 and the 4th Technical Seminar on Chemical Spills in February 1987 with their respective proceedings;
(c) producing the Spill Technology Newsletter in the first month of each quarter; and
(d) providing an annual report and quarterly project status reports.

Task 3 - Convene technical working group and management committee meetings at least once, update the division's operational plan by November 1986, and produce a Work Plan for 1987/88 by February 1987.

Task 4 - Serve on: the technical committee for the 1987 Oil Spill Conference; the ESRF program study committee for oil spill research and countermeasures; and the review committee for the NOGAP Beaufort Sea Response Manual.

Status Report - March 31, 1987

Task 1 - A prototype reverse osmosis-activated carbon system with operating personnel was dispatched to Canning, N.S. for 3 weeks in response to an Atlantic Region request and removed pesticides from 95,000 L of collected surface run-off and washwater resulting from the cleanup following a fire in an agricultural warehouse; the approximately $25,000 cost has been offset using funds freed by deferring planned work on lasers. The unit was also deployed to demonstrate its capabilities at two locations in Alberta and at one each in Manitoba and Saskatchewan (see Highlights item 14).

Technical advice provided on request included:

(a) comments on the Environmental Assessment Panel's report on West Coast drilling, and on a final draft manual for PCB management;

(b) incident-specific information for numerous spills, including:
- coal tar into the Rideau River at Ottawa;
- an after-hours suspected pesticide loss in Quebec Region;
- oil escaping from the sunken fishing vessel MV Transpac;
- butylcellusolve in Quebec;
- lignosulfonic acid in the NWT;
- Permafill at Halifax;
- diesel at Ottawa;
- naphtha-contaminated sunflower-seed oil at Montreal;

(c) detection and quantification information to Quebec Region for the hydrocarbon waste disposal site in Montreal East.

(d) oil separator and asphalt incineration information to Nfld. District office;

(e) information and recommendations on chemical spill analysis and personal protection equipment to the CCG;

(f) comments to the scientific advisor on the final report on the ESRF study to develop a plan for data acquisition at the scene of a major marine oil spill;

(g) comments to the US MMS on their draft report summarizing Arctic oilspill countermeasures;

(h) participation as an alternate member at the 1st meeting of the LUST Program Review Committee;

(i) presenting a paper at Response '86 in Vancouver on chemical spill countermeasueres technology development;

(j) decontamination procedures for railway cars;

(k) information to Dr. Dirschl on Canadian technology of possible interest Indonesia;

(l) briefing visiting EPA officials on potential cooperative projects;
(m) advice to the management of the MacLaren mill at Thurso, P.Q. on ways to improve preparedness for chemical emergencies;
(n) information on reverse osmosis equipment sources to ESSO Resources for their Quirk Creek pilot plant project resulting from one of the previously mentioned demonstrations in Alberta;
(o) briefing J. Litton, a member of the Minister's staff, on EETD's role and capabilities, and
(p) giving an invited paper on spill modelling at an AES workshop 4 February, and another on spill safety at the 4 March meeting of the Pollution Control Association of Ontario (PCAO).

Task 2 - Eleven manuscript (EE-series) reports and 1 EPS-series report were produced. A BIOS overview final report was published in both official languages, with its cost being shared equally by the Canadian Petroleum Association.

The 9th AMOP Technical Seminar took place in Edmonton 10-12 June with 116 registered attendees and pre-published proceedings containing 44 papers, including 18 by foreign authors. Selected authors were invited to contribute papers for the 10th AMOP Technical Seminar scheduled for 9-11 June 1987 in Edmonton. There were 175 registered participants at the 4th Technical Seminar on Chemical Spills in Toronto 10-12 February 1987, and 9 of the 25 papers in the pre-published proceedings were provided by organizations in the U.S.A.

The goal of publishing the Spill Technology Newsletter during the month of issue has been achieved. All four issues for FY 86/87 have been published.

The annual report on planned and unplanned work in 1985/6 was provided, as were the reports for the first, second and third quarters of FY 86/7. A provisional outline of the FY 87/8 Work Plan was sent to the REEC's and to selected HQ individuals; the resulting comments were reflected in the finished product.

Task 3 - The Surveillance and Monitoring of Oil Spills technical committee met in April and again in July when the Analytical, Oil Properties and Chemical Properties technical committees also met to advise on FY 87/8 work. The Fate and Effects Working Group was canvassed for study needs for next year. K. Meikle briefed PY, WN and ATL region staffs on EETD's activities and fields of expertise and attended 2 REEC meetings, one in Hull and one in Toronto.

Task 4 - K. Meikle, who is the only foreign member, attended two meetings in Washington of the technical program committee for the 1987 Oil Spill Conference sponsored by the US EPA, USCG and the API; the first meeting was to select abstracts and the second was to review papers.

Meetings of the ESRF PSC were attended in Calgary 15 April and in Ottawa 3 September; no tasks were identified that require 1987 funds. K. Meikle agreed to take-over as Scientific Advisor for an ESRF study of the motion of oil in leads; the final report was reviewed and accepted after the review comments had been satisfactorily addressed. The final draft of the NOGAP Beaufort Sea Response Manual was reviewed, comments were provided on a contractor's proposal for Phase 2, and K. Meikle took part in a 2-day workshop in Vancouver 25-26 February to review the final draft manual.

OILSPILL COUNTERMEASURES - ENGINEERING SECTION (4542-96100)

Environmental Emergencies Technology Division
Project Manager: H. Whittaker (613-998-9622)

Objective

To develop, evaluate and demonstrate innovative oilspill countermeasures equipment and technology under controlled and field conditions.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Serve as Scientific Advisor for the ESRF study to develop an in-situ burner for stranded oil and complete the technical review of the contractor's final report by January 1987.

Task 2 - Test a prototype airborne laser system for igniting oil slicks at the U.S. OHMSETT facility by December 1986.

Task 3 - Serve as a member of the OHMSETT Interagency Technical Committee (OITC) that determines what equipment and techniques are tested, and sets the test objectives.

Task 4 - As part of an informal cooperative information exchange arrangement, advise the Japanese Institute of Ocean Environmental Technology during the planning and conduct of their tank tests to determine the effect of waves and current on the ability of highpressure waterjets to control oil slicks.

Task 5 - Co-fund laboratory-scale tests by the U.S. National Bureau of Standards with the U.S. Minerals Management Service and the U.S. Coast Guard with the objective of predicting the amount of unconfined oil that can be burned in-situ on water.

Task 6 - Determine the ability of the prototype waterjet barrier to function in drifting ice by testing it in April 1986 during the spring breakup of the St. Lawrence River.

Task 7 - Test the prototype ultrasonic burner in waves at the OHMSETT facility by November 1986.

Status Report - March 31, 1987

Task 1 - A revised final report was received on the ESRF-funded experiment that demonstrated that stranded oil can be effectively burned off common types of shoreline and Phase 2, design of an operational burner, was completed. The ESRF contractor's final report on burning oil in leads was also reviewed and accepted.

Task 2 - The plan to assemble and test a prototype laser ignition system at OHMSETT was deferred for at least a year because ESRF funding was a victim of industry budget cuts. Aass Engineering briefed the Canadian and Quebec Forestry Services on a proposal to develop a modified system for forest-fire control and the prospects for funding appear to be good. The results of all work done with Canadian funding were reported in a paper contributed for the 1987 Oil Spill Conference at Baltimore.

Task 3 - K. Meikle attended 2 meetings of the OITC at the MMS HQ, Reston, Va. to review progress and plan the program for the year commencing 1 October 1986.

Task 4 - Completed. Ms. Laperrière visited the Institute of Ocean Environmental Technology, Tsukuba, Japan for a week in June and for 2 weeks in October to help them plan and conduct highpressure waterjet experiments that confirmed that a pressure of at least 1000 psi is required. EETD also loaned them a floating jet assembly. The details are reported in a paper that will be presented at the AMOP seminar in June 1987.

Task 5 - The agreed share of the cost ($49K) for burning experiments by the U.S. National Bureau of Standards was paid with FY 85/6 funds. The work has been completed and the results were reported at the 9th AMOP seminar.

Task 6 - The functional test of the waterjet barrier in the presence of ice had to be postponed until March 1987 because of an abnormally rapid breakup in 1986. Two days of testing have been completed in the St. Lawrence and St. Charles rivers and the results are being analysed.

Task 7 - The optimum frequency and power for electrically-driven ultrasonic transducers has been determined using a small portable burner built and tested by an engineering student employee. The work was expanded to include tests of the airjet arrangement currently favoured by the inventor. Problems were identified with both when used separately; better results were obtained by operating the jet in series with the transducer. The tests at OHMSETT have had to be postponed indefinitely because of delays in completing maintenance of the facility.

Task 8 (New) - A Memorandum of Understanding with the U.S. MMS was signed 9 September. A joint project agreement was signed 16 September to test the CCG's prototype heavy oil skimmer offshore using oil and to concurrently assess the validity of an offshore boom performance test protocol developed at OHMSETT with OITC funding. FY 86/7 funding ($144,112) has been provided by the MMS and a further $115,000 (US) has been promised for FY 87/8. An initial experimental plan has been prepared by a trials planning committee that includes members from the Atlantic region offices of C&P and DFO. The committee has met three times (at St. John's, OHMSETT and Toronto), and an application for an ocean dumping permit has been made on behalf of the CCG.

CHEMICAL SPILL COUNTERMEASURES - ENGINEERING SECTION (4542-96200)

Environmental Emergencies Technology Division
Project Manager: H. Whittaker (613-998-9622)

Objective

To develop, evaluate and demonstrate innovative chemical spill and leachate countermeasures equipment and technology under controlled and field conditions.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Provide reverse osmosis services and equipment at 2 sites in support of the Zenon UP contract to develop a mobile system for extracting chemicals from groundwater and leachate.

Task 2 - Monitor technology development elsewhere for removing PCB from soil.

Task 3 - Evaluate a method for removing sunken insoluble liquid chemicals at laboratory scale and report results by March 1987.

Status Report - March 31, 1987

Task 1 - Trials of the mobile reverse osmosis unit discharging concentrate to an activated carbon column commenced 14 April at Shell's loading facility on Commissioner Street in Toronto, the first of the two test sites selected for the unsolicited proposal contract awarded to Zenon last FY to develop such a system; the feed was provided from the facility's drainage system. It was found that an ultrafiltration pre-stage removed 95% of the suspended oil and that the 3-stage system removed over 80% of all organics. A 60-day trial at the Gloucester landfill (the second site selected) began 30 June and was completed on schedule. Some 3.5 million litres were processed and reinjected following removal of about 90% of the organics. Data analysis by EETD was completed with unplanned contractor assistance and provided to Zenon for incorporation in their project report.

Task 2 - Work was postponed indefinitely because of resource reallocation following the loss of J. Tremblay's services.

Task 3 - An in-house evaluation of sinking sorbents has been initiated by an engineering student employee. Preliminary results indicate that removals of up to 20 kg pollutant per kg sorbent are possible.

Task 4 (New) - An unplanned study of other removal techniques for sunken insoluble liquids such as ethylene dichloride has been initiated using PY originally allocated for the laser ignition study. Four possible approaches have been identified and over 20 replies were received in response to a problem description forwarded to DSS to obtain statements of qualifications from interested contractors. Eleven proposals were received in response to an RFP for a study of mobile steam-stripping.

OILSPILL COUNTERMEASURES - CHEMISTRY & PHYSICS SECTION (4441-96300)

Environmenal Emergencies Technology Division
Project Manager: M. Fingas (613-998-9622)

Objective

To determine the cold-climate properties and behaviour of spilled oil and the effectiveness of oilspill treating agents.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Help plan and conduct the ESRF Beaufort Sea dispersant trial and review the final report by March 1987.

Task 2 - Participate in the U.S. Marine Board review of dispersant use as a funding-agency member of the steering committee, provide the content for 3 chapters of the final report, and review the full report by March 1987.

Task 3 - Participate in the ESRF oil-in-pack-ice experiment as Scientific Advisor and review the final report by August 1986.

Task 4 - Provide technical assistance for the ESRF simple remote sensor project.

Task 5 - Provide technical assistance to the regional/OGD project officers for the PERD projects to:

(a) field-test OILSPILS and a rig-mounted remote sensor;
(b) develop a new-generation fluorosensor; and
(c) determine the behaviour of submerged oil.

Task 6 - Do Phase 2 of the NOGAP-funded study (oil behaviour in leads) and produce a draft final report by March 1987.

Task 7 - Provide laboratory facilities for a visiting scientist from Japan's Institute of Ocean Environmental Technology (IOOET) to determine the properties of 2 heavy oils by September 1986. (Part of the informal cooperation arrangement involving Task 4 of 4542-96100.)

Task 8 - Extend previous work on the behaviour of oil and gas emerging from a seabed blowout.

Task 9 - Continue 50:50 cost-sharing and technical supervision of an Esso Resources Canada Ltd. project to develop equipment to detect oil under ice, making an acoustic detector commercially available by December 1986.

Task 10 - Complete the oil properties catalogue by March 1987.

Task 11 - Determine the effectiveness and toxicity of new dispersants and continue the re-testing of selected samples from stored supplies as required.

Task 12 - Investigate the oil-dispersant interaction phenomenon that was identified last year as a critical knowledge gap.

Task 13 - Maintain the towed fluorometer and other field equipment in readiness for deployment as required.

Status Report - Mar. 31, 1987

Task 1 - COAATF meetings in Calgary were attended in April and in September. The trial took place 14-16 August as planned except that the towed fluorometer was put out of action by the towing vessel just prior to dispersant application, thereby eliminating the only provision made for measuring oil in the water column. EETD exceeded the planned level of support by diverting an additional $20K from overestimated costs elsewhere to provide remote sensing coverage by CCRS. This action produced the only long-term (48-hour) record of the behaviour of the treated and untreated oil. EETD also absorbed the travel and living costs for the 2 regional staff who, with M. Fingas, were members of the conducting team. The experiment proved that dispersants can be applied in Arctic waters from a helicopter. The effectiveness of the operation will not be known until about mid 1987 when CCRS completes analysis of the data obtained with their remote sensors; however, it is known that all five slicks (including the untreated ones) were still visible to the remote sensors 48 hours after they were formed.

Task 2 - M. Fingas has attended 3 Washington meetings of the committee appointed by the Marine Board of the U.S. National Academy of Sciences to review the use of dispersants at sea. He is one of the funding agency observers, has provided the majority of the material for the sections on effectiveness and the measurement thereof, and has reviewed the drafts of those sections. P. Wells is a member of the committee, chairman of the effects sub-committee, and is writing the toxicity section. EETD covered the travel and living expenses to enable the chairman of the effectivenss sub-committee to observe the Beaufort Sea trial. The study is scheduled for completion in 1987.

Task 3 - Completed. A summary report of the March 1986 ESRF oil-in-pack-ice experiment was presented at the AMOP seminar in June and the contractor's final report has been accepted. There were indications that: oil and ice floes drift at the same rate under the influence of wind and current; the spreading of oil in pack ice is dramatically slower than it is in open water; brash ice concentration appears to be the governing factor; and in situ burning is an effective removal method in high ice concentrations.

Task 4 - The final report on the ESRF development of a simple remote sensor is 21 months overdue; otherwise, the project has been completed.

Task 5 - All 4 PERD-funded projects are on schedule. Terms of reference for OILSPILS work were developed in consultation with the regional project officer in Yellowknife, the experimental work has been completed and the draft final report has been reviewed. The terms of reference developed by Atlantic Region for rig-mounted sensor work were reviewed, as was the contractor's final report. Funding for the CCRS new laser fluorosensor project was reduced from $160K to $40K, permitting only minimal further work pending new funding. M. Fingas met with the regional project officer in Halifax to review the report on previous work on submerged oil and to define the objectives for 1986/7. The study used real oil and has verified the results of previous work using simulated oil; water does wash over masses of oil on the surface.

Task 6 - NOGAP provided $48K and contract was awarded to study the behaviour of oil in leads. The experimental work was performed in NRC' Ottawa manoeuvering basin. The final report has been received and finds that most of the oil is deposited and fragmented on the surface of the ice by the freezing process and that subsequent weathering increases the fragmentation and makes the oil even less amenable to countermeasures.

Task 7 - Completed within bu[illegible]. Dr. Yazaki, Director of the IOOET visited EETD in May to view f[illegible]ities and Mr. Yanagisawa of his staff worked on heavy oil properties in the lab for 2 weeks in June with help from a Japanese-speaking contractor doing other in-house work.

Task 8 - A sea-bed blowout study extending previous work by Dr. Topham was deferred 1 year at the request of Dr. Rowe of U. of Calgary. The freed resources were diverted to the Beaufort Sea dispersant trial.

Task 9 - The prototype acoustic oil-under-ice detector was tested successfully on sea ice in the Beaufort in May with some degradation of transducer-to-ice coupling under melting conditions. Good, first-ever, ice undersurface impressions were obtained by Parks Canada divers using their technique for obtaining underwater impressions of surface detail of shipwrecks; associated costs were absorbed by Parks Canada. The University of Western Ontario has been contracted by Esso Resources to complete the investigation of the feasibility of detecting oil under ice using radar frequency energy by summarizing the progress made. The work was completed and this joint project is finished.

Task 10 - The oil properties catalogue has been updated and expanded by a contractor using EETD's laboratory facilities.

Task 11 - The budgeted $15K was transferred to the Atlantic region and a contract for dispersant testing has been awarded to G. Harris. Six new products and 6 samples of stock in storage have been tested. All except two of the new products met minimum guideline requirements; one of those that failed was BIO SOLVE, a product being introduced into Canada with strong promotion by its U.S. manufacturer.

Task 12 - The contract for the study of oil/dispersant interaction was awarded to D. Mackay. The draft final report has been received and it has been found that dispersants do not mix nearly as readily with oil as has been thought.

Task 13 - Salt-water damage to one of the two fluorometers for the towed system was repaired in preparation for its use in the Beaufort Sea dispersant test. It was put out of action by poor ship-handling before any data was obtained and repair of the damage sustained awaits FY 87/8 funds.

Task 14 (New) - Unplanned technical assistance and $3K "seed money" from savings elsewhere have been provided to PYR for a cooperative project with B.C. to develop a simple remote sensor for oil slicks using filters on a standard TV camera.

Task 15 (New) - A joint project agreement was signed with the U.S. MMS to do an offshore sea-trial of 2 new treating agents in 1987 using oil. One is an emulsion inhibitor and the other makes oil visco-elastic. Laboratory work and development of the experimental plan is ongoing at the RRETC and $31,746 has been received from the MMS for the tank tests and sea trials to follow. It has been found that the use of ELASTOL makes oil substantially more recoverable by skimmers, but it does not suppress its flashpoint and it does not mix readily with the oil.

Task 16 (New) - Some resources allocated to Task 13 were diverted and work on Task 15 was deferred to undertake unplanned experimental work at the RRETC to investigate the claimed ability of BIO SOLVE to reduce the hazard caused by vapours from spilled gasoline and similar volatile hydrocarbons. Approximately $10K were expanded and it was conclusively demonstrated that the application of BIO SOLVE or similar products on the market, and all of the several commonly used dispersants always increases the potential for explosion in sewers.

Task 17 (New) - At the request of the ASTM, the task of drafting ASTM guidelines for the use of dispersants on permeable ground and impermeable surfaces was accepted and work is in progress as a voluntary overtime activity.

CHEMICAL SPILL COUNTERMEASURES - CHEMISTRY & PHYSICS SECTION (4441-96400)

Environmental Emergencies Technology Division
Project Manager: M. Fingas (613-998-9622)

Objective

To determine the cold-climate properties, behaviour, and effects of chemical spills and spill treating agents.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Complete an EnviroTIPS manual on PCB by December 1986.

Task 2 - Partially fund the Pacific Region's Thompson River unsolicited proposal study initiated in 1985/6.

Task 3 - Give three 1-week courses on personal protection and portable field analytical equipment (April, May and September 1986).

Task 4 - Update the list of priority substances for emergencies purposes.

Task 5 - Extend the short-term toxicity determinations begun in 1985/6.

Task 6 - Complete post-installation testing of the prototype mobile field analytical system by August 1986, and extend and demonstrate its capability by March 1987.

Task 7 - Produce a first draft of a manual on the basics of chemical spill cleanup by December 1986.

Task 8 - Produce a draft expanded edition of the Manual for Spills of Hazardous Materials by March 1987.

Task 9 - Continue extending the capability of the portable field analytical system and test the susceptibility to interference of the method devised in 1985/6 for PCB.

Task 10 - Develop a near-surface air sampler for spilled chemical gases and vapours.

Status Report - Mar. 31, 1987

Task 1 - The PCB EnviroTIPS manual production was re-scheduled because work was interrupted by a change of ownership of the contractor; the draft manual was received 31 Mar. and will be reviewed by the ad hoc government/industry committee assembled at the beginning of the undertaking.

Task 2 - Completed. The planned $30K was transferred to the Pacific Region for their Thompson River chemical spill study initiated by a UP last year. The results from the countermeasures component (a review of the available technology) were presented at the Technical Seminar on Chemical Spills in February.

Task 3 - Completed. The April, May and June 1-week courses combining refresher training on the use of personal protection equipment with user training on the portable field analytical system were given; total of 45 attended, of which 26 were C&P employees.

Task 4 - A chemistry student summer employee assembled the data for the updating of the list of priority substances as planned. Additional work was also completed using a supplementary term ¼PY; most of the tables needed to complete the task in FY 87/88 are now available.

Task 5 - The budgeted $25K has been transferred to the Atlantic Region and the determination of the short-term toxicity of a further 20 chemicals was contracted to G. Harris. The work has been completed and a report will be published in FY 87/88 after being technically reviewed.

Task 6 - Post-installation testing of the mobile (Level 3) field analytical system has been completed. The reference database was expanded to 100 substances and work is therefore well ahead of schedule. The system was demonstrated in Toronto in February.

Task 7 - The information-gathering phase for the basics manual on chemical spills was completed by a student summer employee and a technical draft has been produced by a contractor.

Task 8 - It was decided to defer production of a draft and to extend the information gathering phase for the expanded 2nd edition of the Manual for Spills of Hazardous Materials. Data on over 100 additional chemicals has been assembled by a contractor working in-house.

Task 9 - The planned further extension of the capability of the portable analytical system was completed by a contractor working in-house, beginning with completion of work on its PCB component. The work was accelerated with a supplementary term ¼PY and over 20 tests for different chemicals or groups of chemicals have been added.

Task 10 - A remotely-controlled near-surface air-sampler consisting of a radio-controlled helicopter with camera and sensor package was constructed and has successfully undergone initial flight tests, thereby completing the work planned for this year.

OILSPILL COUNTERMEASURES - W&N OFFICE (4441-96500)

Environmental Emergencies Technology Division
Project Manager: G. Sergy (403-468-8030)

Objectives

1. Manage the BIOS project and follow-on studies.

2. To develop recommendations on the use of biological tests to protect water quality from the consequences of oil pollution.

3. To determine the effects of cold-climate oilspills and related countermeasures.

4. To develop improved countermeasures for oil on low-energy shorelines.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Complete publication of the results of the main BIOS project in the journal "Arctic" by November 1986.

Task 2 - Produce a final non-technical summary report on the BIOS project by May 1986.

Task 3 - Report the results of the 1985 follow-on fieldwork on the BIOS site by June 1986.

Task 4 - Identify existing and potential applications of biological tests, recommend core tests and principles for use nationally, and recommend the in-house testing capability for each operational centre by March 1987.

Task 5 - Serve as a member of the review committee for the NOGAP benthic point-source monitoring project.

Task 6 - Complete the layman's manual on the effects of spilled oil by March 1987.

Task 7 - Prepare a draft plan by March 1987 for an experiment to determine the fate and effects of oil on a West Coast beach.

Task 8 - Determine the toxicity of 20 selected crude oils and refinery products.

Task 9 - Monitor the ESRF oiled salt-marsh study.

Status Report - March 31, 1987

Task 1 - 21 manuscripts have been accepted by "ARCTIC" and are "In Press"; 3 manuscripts are still being revised by the authors following peer review. Publication of the BIOS special edition is expected to be July 1987.

Task 2 - Completed. The final non-technical summary report on the BIOS project was distributed in June in both official languages as a joint publication of Environment Canada and the Canadian Petroleum Association.

Task 3 - Completed. The contractor's final report on the 1985 BIOS follow-on field-work has been published as an EE-series report.

Task 4 - Potential applications for biotests were identified from responses to a questionnaire and subsequent regional visits. A workshop was convened in November to select national core aquatic toxicity tests. A discussion of in-house testing capabilities was completed and a presentation was made to the IWD annual biologists' meeting. A final draft report entitled "Recommendations on Aquatic Biological Tests and Procedures for Environmental Protection, C&P, DOE" has been submitted to the Laboratory Managers Committee for review. It makes recommendations for management decisions and action to strengthen the use and improve both the availability and the quality of biotesting. It also:

- identifies current and potential applications;
- selects a set of national core aquatic toxicity tests;
- delineates, a national in-house testing capability and its implementation;
- outlines a national protocol development strategy for the core tests and the action needed for a quality assurance program.

Task 5 - There were no meetings of the NOGAP Benthic Point Source Monitoring Committee.

Task 6 - R. Percy has agreed to take the project over. The first complete draft was distributed to selected reviewers and their comments have been incorporated. Remaining work had to be deferred until FY 87/8 because the funds were expropriated.

Task 7 - Planning a West Coast oiled-beach experiment was deferred at least a year because Task 4 required more time than was budgeted and the associated funds were expropriated.

Task 8 - The tests to be used to determine the toxicity of oils were selected and the 20 oils were identified. Terms of reference and a protocol were developed in consultation with the Atlantic Region Laboratory, which agreed to do the work for $30K. Oil solubilities were determined and the test results have been reported.

Task 9 - The field work for the ESRF oiled salt-marsh study has been completed and the draft final report was reviewed.

CHEMICAL SPILL COUNTERMEASURES - W&N OFFICE (4441-96600)

Environmental Emergencies Technology Division
Project Manager: G. Sergy (403-468-8039)

Objectives

1. To determine the effects of chemical spills and related countermeasures.

2. To develop recommendations on the use of biological tests to protect water quality from the consequences of pollution by toxic substances other than oil.

Relevance

Supports the departmental and national capability to minimize the adverse effects of spills and similar environmental emergencies. Relates to priority issues to the extent that the event involves a toxic substance, geographical area, resource, or similar focus of attention.

Work Plan

Task 1 - Identify existing and potential applications of biological tests, recommend core tests and principles for use nationally, and recommend the in-house testing capability for each operational centre by March 1987.

Task 2 - Serve as a member of the review committee for the NOGAP Benthic Point Source monitoring project.

Status Report - March 31, 1987

Task 1 - See 96500 Task 4.

Task 2 - See 96500 Task 5.

ANALYTICAL SERVICES DIVISION

Project Number	Project Title	Page Number
97100	Organic Analysis	51
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97500	Technical Support and Advice	60

ORGANIC ANALYSIS (2125-97100)

Analytical Services Division
Project Manager: C. Chiu (998-3671)

Objective

Provision of trace and ultra-trace organic analyses on a variety of samples including ambient air and source emission (stack) samples; vehicle exhaust emission samples; industrial process feedstocks, ashes, wastewater and leachates; oils, soils, sediments and groundwater related to chemical spills and landfill operations; and other related matrices of environmental concern. Such samples usually are analyzed for a number of organic constituents. Some of the more commonly measured compounds include dioxins and furans; polychlorinated biphenyls (PCB); chlorinated benzenes and phenols (CB, CP); polycyclic aromatic hydrocarbons (PAH); pesticides; aldehydes and alcohols. Other aliphatic and aromatic compounds may be analyzed as required.

Relevance

Dioxins and furans are among the most toxic chemicals known and, along with other chlorinated organic compounds such as PCB's, chlorinated benzenes and chlorinated phenols, can pose serious environmental threats. Other organics like PAH's are known carcinogens. Accordingly, there is considerable concern in the general population over the hazards of such substances to health, property and the environment. Such toxic organic substances can be produced from a variety of industrial processes and can also be of environmental concern in waste dump sites or accidental spill situations. Accordingly there is a need for timely and accurate analysis of such compounds and research on methods of measurement and removal of such substances from the environment.

Work Plan

1. Analyze over 900 samples for dioxin/furan, PCB/CB, PAH and CP in source emission and process samples from the Quebec City NITEP/Combustion Tests.

2. Continue routine ambient PAH analysis to Sept. 86 and provide analytical assistance to evaluate dioxin/furan and nitro-PAH levels on collected filters and foams.

3. Analyze samples collected from PCP-treated woodwaste incineration studies for dioxin/furan, CP and other chlorinated compounds.

4. Analyze QA samples for dioxin/furan and PCB collected from the plasma pyrolysis evaluation testing at RMC, Kingston.

5. Analyze sediment samples from Vancouver Harbour and Fraser River Estuary for PAH and priority pollutants.

6. Analyze vehicle emission and ambient air samples for aldehydes.

7. Provide organic screening analysis for source testing samples collected at the Summerside, P.E.I. FBC evaluation project.

8. Provide emergency analysis for PCB and dioxin in response to chemical spills or other environmental concerns.

9. Provide QA/QC analysis on samples from pulp mill wastes treated by membrane extraction.

Status Report - March 31, 1987

1. In support of the NITEP/Quebec combustion tests, 20 proof-rinse samples, 70 train samples, and 51 ash samples were analyzed for PCDD/PCDF, CB/PCB, CP and PAH. Results were forwarded to IPB and two contract labs. The remaining refuse, leachate and leachated ash samples were extracted and are being analyzed on the GC/MS.

2. Ambient PAH results of 138 samples were reported to PMD. This concluded our commitment to the current ambient PAH program.

3. At the request of B.C. MOE, five sets of ambient air samples consisting of 15 component filters and foam plugs from the burning of wood wastes were analyzed for PCDD/PCDF. An analytical report was prepared and submitted to Pacific Region for transmittal to the Province.

4. No activity.

5. Analyses of 14 sediment samples from Vancouver harbour for PAH were completed and results were forwarded to Pacific Region.

6. No activity.

7. No activity.

8. Emergency analyses of four sets of ambient air samples for PAH emission from sites of the coal tar cleanup and disposal operation in Ottawa were completed and results were submitted to PMD. In response to another coal tar leakage incident in Ottawa, ASD provided emergency analysis of one fuel oil and two soil samples for PAH contamination. Results were submitted to Ontario Region.

   Emergency PCB analysis of one (waste) transformer oil was completed and results reported to National Defence. A waste oil sample submitted by R. Lafleur of EMR was analyzed for PCB contamination.

In response to a pesticide fire in Canning, N.S., we were requested to perform PCDD/PCDF analysis for eight vegetation and pesticide samples. We also coordinated the analysis of various other samples for pesticides by Agriculture Canada and milk samples for dioxin/furan by National Health and Welfare Canada. Results were forwarded to Atlantic Region.

Results of volatile organic analysis for three indoor air samples collected within the RRETC were submitted by Mann Testing Lab. These results were interpreted in the report prepared by Dr. Lao. Copies of the report were distributed for review and comment.

Two fire soot samples from Labrador were received for PCDD/PCDF analysis.

9. Analysis of PCDD/PCDF in six Kraft Mill effluent sludge samples from the Boat Harbour facilities at Pictou, N.S. were completed and results forwarded to Atlantic Region.

At the request of Saskatchewan Environment, six sludge samples from Albert Pulp mill were received for dioxins/furans analysis.

SAMPLES ANALYZED BY ORGANIC LABORATORY, ASD
APRIL 1, 1986 - MARCH 31, 1987

SAMPLE TYPE	SAMPLES PROCESSED	ANALYSES PERFORMED					
		PAH	PCB	CB	CP	PCDD PCDF	TOTAL ANALYSES
Ambient Air	152	138				15	153
Source Emission	136	134	134	134	134	136	672
Effluents & Products	34		14	11	21	30	76
Fires & Spills	26		16			10	26
Transformer Oils	9		9				9
Proofing	20	20	20	20	20	20	100
Method Development	330	201	181	20	26	54	482
Solvent Wastes	40		40			40	80
TOTAL	747	493	414	185	201	305	1598

INORGANIC ANALYSIS (2125-97200)

Analytical Services Division
Project Manager: J. Dlouhy (998-3671)

Objective

Provision of inorganic analyses on samples collected from the National Air Pollution Sampling (NAPS) Network; source emission (stack) testing studies; special ambient air monitoring projects; and retail gasoline sampling tests. Typical sample matrices include filters, impinger solutions, process feedstocks and ashes and gasolines. Samples are analyzed for inorganic elements and compounds of environmental significance such as acid rain related substances (sulphate, nitrate); other common anions (fluoride, chloride, phosphate, nitrate); toxic metals (lead, mercury, arsenic, selenium); and multi-element assays (34 elements) of dichotomous and hi-volume filter particulates.

Relevance

The NAPS network is used to collect data on ambient air pollution levels in centres across Canada. Special ambient air surveys are also conducted to measure levels of toxic inorganics identified under the Clean Air Act. Data on levels of inorganic compounds, such as nitrates and sulphates, can be used to delineate the extent of the acid rain problem in Canada and such data can supplement other important studies like the long range transport of air pollutants, which have both regional and international implications.

Work Plan

1. Analyze approximately 3000 NAPS Hi Vol and 3000 NAPS Dichot filter samples for toxic elements and acid rain related anions.

2. Analyze 700 ambient air filter samples for SO4, NO3 and Pb in support of an NH&W acid rain epidemiology study.

3. Continue analyses of Yellowknife Hi Vol filters for arsenic.

4. Transfer SO4/NO3 analyses from Technicon to Ion Chromatograph and incorporate multi-element capability with the new EDXRF spectrometer.

5. Analyze gasoline samples submitted by regional offices to determine compliance with leaded gasoline regulations.

6. Analyze filter samples from the Cornwall Island monitoring network for particulate and gaseous fluorides.

7. Provide multi-element analysis of 1985 archived filter samples from the NAPS network.

Status Report - March 31, 1987

1. A total of 5403 hi-vol and dichot filter samples were processed in the laboratory. Samples are analyzed for lead by X-ray fluorescence and multiple anions (SO4, NO3, NO2, PO4, Br) by Ion Chromatography.

2. A total of 822 filters were analyzed for lead, sulphate and nitrate in support of the NH&W epidemiology project.

3. No activity.

4. Experiments on different methods of filter extraction and analysis were started to investigate the transfer of sulphate/nitrate analyses from the Technicon analyzer to the Ion Chromatograph for production work. An extraction procedure using boiling water appears to hold some promise in eliminating the difficulties with wetting agents required for the Pallflex filters. A new autosampler for the Dionex system was installed which allows automatic filtration of samples and sealed sample vials prevent evaporation and cross-contamination.

   The new EDXRF spectrometer was delivered and initial set-up and training by the manufacturer was completed. Afterwards, considerable hardware problems developed resulting in replacement of four X-ray tubes and high voltage power supplies. By the end of the 2nd quarter, complete automation of the X-ray instrument (measurement, deconvolution, quantitation) was implemented. As part of the new XRF method development, a comparison of selected metal results by three different methods (EDXRF, WDXRF, IC) is being carried out.

5. No activity.

6. A total of 191 field samples from the Cornwall fluoride project were delivered to the laboratory and analyzed.

7. A total of over 1000 regular dichot filters and about 200 archived dichot samples were analyzed for 40 elements per sample by the new energy dispersive X-ray spectrometer. An additional 700 QA/QC, calibration and blank samples were processed along with these samples. A standardized reporting format to organize this large amount of data in a client useable format was developed and the first batch of analytical results transferred to PMD by EDP techniques.

SAMPLES ANALYZED BY INORGANIC LAB, ASD
APRIL 1, 1986 - MARCH 31, 1987

	SAMPLES ANALYZED (per year)	ANALYSIS PERFORMED (per year)	ANALYSIS PERFORMED (per month)
Methods other than Kevex X-ray Spectrometer			
Samples	7776	14738	1228
QA/QC	362	863	72
Calibration	1047	2613	217
Blanks	727	1578	131
Kevex X-ray Spectrometer (for 9 months)			
Samples	1296	51840	5760
QA/QC 1	280	11200	1244
QA/QC 2	280	11200	1244
QA/QC 3	41	1640	182
Calibration	60	2400	266
Blanks	32	1280	142
Total			
Samples	8672*	66578	6988
QA/QC	963	24903	2742
Calibration	1107	5013	483
Blanks	759	2858	273
Totals	11501	99352	10486

* Corrected by 400 (4 batches of Dichot filters reported in other methods)

QA/QC ACTIVITIES (2125-97300)

Analytical Services Division
Project Manager: B. McDonnell (998-3671)

Objective

Coordination of QA/QC projects for the Federal-Provincial Advisory Committee on Air Quality (FPACAQ), evaluation of QA/QC protocols for EPS-administered contract analyses and development of method formats and QA/QC procedures for ASD lab operations. QA/QC activities involve techniques to ensure that a laboratory is generating data of proven and known quality. One of the key ways of doing this is through the administration of analytical method round-robins between laboratories. The application of statistical techniques to the data from such studies provides measures on the precision and accuracy of analytical results.

Relevance

In order to improve and document the reliability of environmental measurements, quantitative measures of laboratory performance are required. Collaborative studies yield data in sufficient quantity to allow statistically valid performance standards to be established for analytical work.

Work Plan

1. In support of FPACAQ programs, complete round robins for SO2 and H2S in gas cylinders and heavy metals in smelter dust and initiate round robins for sulphate, nitrate and fluoride in filter strips.

2. In support of CCREM committee directives, complete the round robin of PCB in transformer oils and initiate a round robin on PCB in soil and sediments.

3. Based on responses to an ASD questionnaire, the following interlab round robins will be planned for this year: lead, bromide and sulphate on filter strips, lead in gasoline, CO in gas cylinders and PAH in ash or particulate.

4. Continue development of QA/QC protocols and a standardized method format for ASD laboratory methods used in routine analysis.

5. Develop and evaluate QA/QC protocols for EPS-administered contracts as requested.

Status Report - March 31, 1987

1. The SO2 and H2S round robins and the first draft of the analytical report describing the results have been completed. Discussions have been had with commercial firms regarding the preparation and stability of their gas standards.

   The analytical work has been completed for assessing the homogeneity of PD-3 (Noranda smelter dust). Testing has revealed that PD-3 is mixed but not homogeneous. It will have to be reblended before use in a round-robin. The literature search on the homogeneity of powdered solids is continuing.

   The round robin and a final report for sulphate, nitrate and fluoride have been completed. Twenty-three of the original thirty-three laboratories contacted supplied data. Technical support in the form of consultation and additional samples has been provided to some of the participants.

   A report of QA activities in -86 was prepared for the annual FPACAQ meeting in Vancouver in May.

2. The round robin for PCB in transformer oils was completed and the final analytical report has been approved and printed.

   An unsolicited proposal for the preparation of PCB bearing waste oil and sediment samples was received from Ocean Chem Ltd. of Dartmouth but rejected because of lack of funds under current fiscal restraints. A marine sediment PCB reference material has been purchased from NRC Atlantic Research Laboratory.

3. A Halifax harbour sediment, suitable for use in an interlaboratory study for PAH, has been provided by the NRC Atlantic Research Laboratory. Work has begun on evaluating methods for the analysis of PAH in sediment, waste motor oil, and atmospheric particulate and for assessing the homogeneity of the solid samples. Only one matrix will be chosen per survey.

   An interlab round robin is being planned for sulphate and nitrate using both filters and aqueous solutions and another for sulphate, lead and bromide on Pallflex (Teflon coated) filter strips at concentrations corresponding to those found in the NAPS surveys.

4. No activity.

5. The precision statements for the lead in gasoline method EPS-1-AP-73-3 were reviewed in the light of data received in the 1985 NRC sponsored round robin.

   Precision statements have been reported for PCB in transformer oil on the basis of data obtained in the 1985 FPACAQ round robin.

METHOD DEVELOPMENT (2126-97400)

Analytical Services Division
Project Manager: M. Bumbaco (998-3671)

Objective

Develop new procedures or refine existing methods for the determination of organic and inorganic compounds in ambient air, source emission or other environmental samples.

Relevance

Regulations or guidelines promulgated by the Department to limit the amount of substances present in the ambient air must be supported by scientifically sound reference methods. These methods will specify the equipment and procedures which must be used to obtain acceptable results.

Work Plan

1. Complete lab research and prepare recommended methods for the measurement of ultra-trace levels of dioxin/furan, PCB/CB, PAH and CP in emission samples from MSW incinerators.

2. Refine recommended methods for the analysis of PCB in transformer and waste oils, soil and sediments.

3. Develop recommended method for the analysis of PCB in ambient air samples.

4. Complete revisions to the lead in gasoline reference method based on results of the CGSB inter-lab study on precision of the method at the 0.29 g/L level.

5. Complete revisions and publish the recommended method for the analysis of HF in ambient air filter samples.

6. Develop analytical procedures for the determination of nitro- PAH and other substituted PAH compounds in ambient air filter and foam plug samples.

7. Update SRM's for organic and inorganic analysis of ambient air and source testing samples as required.

8. Conduct a literature search of protocols and analytical methods used for testing of commercial chemicals.

Status Report - March 31, 1987

1. Modifications to procedures used to analyze refuse samples are being tested. The dark coloured matrix co-extracted from some samples had an adverse effect on both identification and quantitation of target compounds.

   Several detailed methodology schematics were prepared which will be used as models in preparing the final procedures.

   An Ion Trap Detector (ITD) was evaluated in regards to sensitivity, mass spectrum and software capability using dioxins and PAH working standards.

   Low recovery of dioxins and PAH on some boiler/economizer and precipitator ashes were encountered. Several extraction techniques are being studied. The extraction efficiency seems to have improved significantly on some ashes simply by ultrasonicating ashes with 6 N HCl and benzene prior to soxhlet extraction and covering extractor bodies with aluminum foil during the process of soxhlet extraction.

An experiment of separating the fraction containing lower M.W. dioxins/furans from the higher M.W. fraction dioxins/furans and other compounds using HPLC is being carried out. This fractionation step is desirable for GC/MS isomer specific analysis.

2. Responses were made to technical comments provided by several regions and provinces on our draft procedures for PCB in Oil and PCB in Soils and Sediments. Additional lab work is underway to develop the final protocols.

   Two extraction techniques for the determination of PCB in soil and sediment were compared. Precision and accuracy of the preferable procedures are being studied using both NRC standard reference materials and CCIW round robin materials.

3. No activity.

4. Data from the NRC/CGSB inter-lab round robin evaluation of the Pb in gasoline method was evaluated. We do not believe these new data are significantly different from the current method so feel a revision to the method is not justified.

5. No activity.

6. Preparation of analytical equipment and supplies was initiated and preliminary runs using liquid chromatography were undertaken. A technique using a disposable Sep-Pak column in a low pressure LC system to separate nitro-PAH for ambient air samples is under testing.

   An NBS diesel particulate (SRM 1650) was analyzed for PAH and N-PAH using our standard ambient PAH procedure. Results were agreeable to the certified nitro pyrene and five PAH compounds.

   K. Li visited the Laboratory Service Section of the Wastewater Technology Centre on March 26 to discuss methodologies for nitro-PAH and other organic analysis.

7. Methods for multi-anion analysis (Br, SO4, NO3, PO4, NO2) of dichot filter samples by the Dionex ion chromatograph were developed.

8. No activity.

TECHNICAL SUPPORT AND ADVICE (2125-97500)

Analytical Services Division
Project Manager: M. Bumbaco (998-3671)

Objective

Provision of technical advice regarding analytical methods, instrumentation, laboratory practise, properties of new chemicals, QA/QC procedures, proposals and contracts.

Provision of analytical support for small projects that develop through the year or for those projects identified in the work plans for which firm details had not been provided. Such support is generally of short duration and low volume so as not to adversely affect ongoing laboratory operations.

Relevance

Requests for support and advice on complex analytical procedures originate from various C&P RCs as well as other government departments, national and international agencies. Such support is of major significance in our laboratory because of the increasingly high profile and attention being focussed on toxic chemicals in the environment.

Work Plan

1. Continue participation in interlab studies of ambient air filter samples with Manitoba Environment, U.S. EPA and Alberta Research Centre.

2. Participate in other interlab round robin studies for organic and inorganic compounds in environmental samples as requested throughout the year.

3. Provide organic and inorganic analysis in response to special requests received throughout the year.

4. Provide technical advice and possible analytical support for pesticide analysis, PAH and phthalic esters in storm waters, hydrocarbons in sediments and related samples.

5. Cover administrative costs required to maintain ASD lab operations including travel funds; equipment service contracts; students and temporary help; demurrage and petty cash; duty and brokerage fees; and small capital items.

Status Report - March 31, 1987

1. Six samples from the US EPA SO4/NO3 round robin were received and analyzed in duplicate by Technicon and Ion Chromatography.

   Nine samples from an interlab QA program with Alberta Environment were analyzed for lead and reported.

2. No activity.

3. At the request of Ontario Region, four space-heater oil samples were analyzed for PCB contamination. Considerable work was done on confirming GC/ECD results by GC/MS techniques. An analytical report was completed and forwarded to the client.

Analyses of four Fire Log samples for PCB were completed. Considerable problems were encountered because of the complex sample matrix and special extraction techniques were developed to overcome these difficulties. Results were reported to Commercial Chemicals Branch on May 27.

Analyses of 16 oil residue samples from the burning of crude oil in Halifax, for PAH (14 samples) and PCDD/PCDF (2 samples) were completed and results were forwarded to EETD.

Special analyses of filter strips for NO3/SO4 were carried out to certify blank values for round robin samples. About 40 analyses were carried out to support this work. Additional nitrate analyses by the more sensitive ion chromatographic method were also carried out.

A Sidney tar pond sample extract was characterized using the GC/MS full scan technique. The mass spectrums of 52 major peaks were examined against NBS Library Search and EPA Mass Spectral Data Base. Results were reported to PMD.

A Norwegian firm, Norsk Hydro, has plans to establish a multi-million dollar magnesium refinery at Becancour, Quebec. At the request of Quebec Region and Quebec MOE, one algal mass and two effluent samples were analyzed for PCDD/PCDF. An analytical report was prepared and forwarded.

Special analysis of 66 Hi Vol filters for lead were reported in support of a monitoring program being set up in Amman, Jordan.

A sample of a commercial surfactant product was analyzed for lead at the request of EETD.

At the request of Ontario Region, eleven wastewater effluent samples from Northern Wood Preservers were analyzed for PCDD/PCDF, chlorobenzene and chlorophenols and an analytical report was prepared.

Due to a large discrepancy of PCB results in three Quebec oil samples among three private laboratories, we analyzed these three oil samples in duplicate using the "standard addition" technique to provide maximum accuracy. Results were forwarded to Quebec Region.

In support of the Duffin Creek STP source testing study, two train samples were analyzed for PCDD/PCDF, CB, PCB, CP and PAH. Results were forwarded to PMD. In addition, two extracts and one ash sample prepared by a contract lab were analyzed for selected organic compounds as part of the QA program.

At the request of EETD, a batch of 7 samples of filter and oil collected from Sweet Alberta Crude Oil burns, were received for PAH, nitro-PAH and full characteristic analysis. These are being analyzed as part of a joint study with U.S. National Bureau of Standards.

4. A program involving regular analyses of ASD solvent wastes for dioxin/furan and PCB was undertaken to ensure safety during disposal. A safety plan for ASD laboratories was developed and is being implemented.

   An invited paper "Use of GC/MSDfor Environmental Analysis" was prepared and presented by M. Lanoy and K. Li at a Hewlett Packard analytical seminar on April 15.

   Dr. R. Lao presented two papers on methodologies for dioxins/furans and related compounds analysis at the 6th International Symposium on Chlorinated Dioxins in Fokuoka, Japan, September 16-19.

   C. Chiu presented a summary of our analytical methodologies and laboratory studies on MSW incinerator samples at a NITEP Municipal Waste Combustion Workshop sponsored by EPA and Environment Canada in Durham, N.C., December 9-11.

5. A total of 80.0K administrative costs were incurred to support the laboratory technical programs during the fiscal year.

Equipment Service Contracts & Repairs	49.5K
Students and Temporary Helpers	19.0K
Cylinder Demurrage	8.5K
Petty Cash, Brokerage, Miscellaneous	3.0K

VEHICLE EMISSIONS TESTING LABORATORY

Project Number	Project Title	Page Number
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MOTOR VEHICLE COMPLIANCE (98001)

Vehicle Emission Testing Laboratory
Project Manager: F. Hendren (998-9590)

Objective

1. To test annually a selected range of new motor vehicles representing the most popular makes and models offered for sale in Canada to determine whether they meet current exhaust emission standards and fuel economy guidelines.

2. To investigate compliance failures in conjunction with Transport Canada and the manufacturers and to take corrective action.

Relevance

It is essential that standards contained in the Motor Vehicle Safety Act are neither circumvented nor ignored by motor vehicle manufacturers; otherwise a further increase in the air pollution burden in Canada caused by light duty motor vehicles could be expected.

Work Plans

(a) Conduct 450 urban and highway exhaust emission tests on 60 to 80 new motor vehicles.

(b) Conduct a minimum of 10 evaporative (SHED) tests both D.B.L and H.S.L.

(c) Test drive 12 to 15 vehicles to 6600 km for a total of 100,000 km.

(d) Investigate 15 to 20 failed vehicles including conducting 100 exhaust emission tests, and provision of technical services and facilities as required.

(e) Prepare reports for Transport Canada on each vehicle and each failure investigation.

Status Report - March 31, 1987

1 (a) **Vehicle Status**

Received	- 133
Returned	- 86
Under Test	- 21
Under Investigation	- 19

(b) **Emission Tests (Compliance Audit)**

Urban - 232
Highway - 106
Evaporative - 5 (4th quarter only)

(c) **Test Mileage Driven**

74,517 km

(d) **Compliance Reports Completed**

1984 models - 3
1985 models - 11
1986 models - 86
1987 models - 8

2. **Compliance Investigations**

(a) **April 7, 1986**

Chrysler (Larry Robinson). High emissions and fuel consumption on five vehicles - 1985 models - LeBaron, Lancer, Reliant, Voyageur, Laser.

(b) **April 24 - May 2, 1986**

Hyundai - high HC emissions on Stellar

(c) **April 25, 1986**

General Motors (Bill Dixon, Marie Turco) observing "0" mile tune check on six new Chevrolet Cavaliers. Vehicles were purchased by TC to further investigate chronic high HC emissions on 1985 and 1986 models. This investigation was completed in December.

(d) **May 5 - 6, 1986**

Ford - high emissions on Lynx Topaz and Escort models. Vehicles to be sent to Ford (USA) for testing in January, 1987.

(e) **August 19 - 20, 1986**

Hyundai (G. Lombardi) - high HC emissions on Stellar

(f) **October 23/24 and November 3-7, 1986**

Skoda (C. Rines) - high CO on 120 GLS model

(g) **Emission Tests (Failure Investigations)**

Urban - 116
Highway - 17

3. A meeting was held between representatives of Transport Canada and Environment Canada on April 30, 1986 to discuss the "Statement of Work" which will specify details of the joint TC/EC Compliance Audit Program for the 1987 and 1988 model year and well into the future. Final agreement on the 1987 program was reached at a meeting in December.

EMISSION TEST EQUIPMENT QUALITY ASSURANCE (98002)

Vehicle Emission Testing Laboratory
Project Manager: Fred Hendren (998-9590)

Objective

To achieve and maintain an internationally recognized accuracy and precision in the measurement of motor vehicle emissions.

Relevance

Environment Canada would have no credibility and thus no influence in motor vehicle matters without accurate test data from the project work undertaken. Decisions based on test results would be meaningless.

Work Plans

(a) In-house calibrations, repair and modifications totalling 75 working days per year on each of three test cells.

(b) Eight cross-correlation projects per year of one week each, including MVMA, JAMA, EPS, Ford, GM, Chrysler and Scott Environmental. Prepare two summary reports.

(c) Conduct a minumum of 200 emission tests.

(d) Complete modifications/renovations to permit testing to new 1988 vehicle standards by September 1987.

Status Report - March 31, 1987

1. The annual Japanese Automobile Manufacturers Association (JAMA) cross-correlation project was carried out at VETL on May 7 and 8, 1986. The test vehicle provided was a 1986 Dodge Colt.

   Emission Tests (JAMA)

   Urban - 5
   Highway - 5

2. Routine in-house quality assurance and cross-correlation activities continued during the quarter.

Emission Tests

Urban - 118
Highway - 170
505-HOT - 170
864-HOT - 28
Evaporative - 3 (4th quarter only)

3. Progress in renovations at VETL is as follows:

- Old HVAC system removed and retained for installation in Test Cell No. 3. Installation of new HVAC system completed on August 8, 1986.

- Work on third fuel conditioning cart and fuel drain cart for unleaded gasoline was completed February 16.

- Construction of half of new test bench completed and testing started in Test Cell #1 in August.

- Contract for automation system for test labs awarded. Hardware received on October 31. Target date for software completion was March 31, 1987. Test Cell No. 1 is now automated.

- Construction of Test Cell #3 including doors, HVAC, drywall and painting has been completed. Test equipment has been installed and cell was operational in January, 1987.

- Jacek Rostkowski won the competition as quality assurance engineer and started work on October 20.

- Heat build automation equipment has been installed. A pilot model was constructed and operated successfully. The system is now in operation.

NEW FUELS AND TECHNOLOGY (98003)

Vehicle Emission Testing Laboratory
Project Manager: Fred Hendren (998-9590)

Objective

1. To determine the potential value and the environmental consequences of alternate fuels and power plants.

2. To develop test methods and to construct the necessary sampling and instrumentation systems for testing unregulated pollutants which cannot be measured with current equipment.

Relevance

It is essential that alternate fuels to gasoline such as diesel, CNG, LNG, LPG, hydrogen, alcohol, methane and coal and alternate power plants to the internal combustion engine such as diesel, Wankel, Stirling, turbine and hybrids are thoroughly evaluated and tested to ensure that there will be no adverse environmental consequences resulting from their use.

Methods must be developed to measure precisely various unregulated pollutants of known health hazards to determine the magnitude of this hazard so that corrective measures can be introduced if necessary.

Work Plans

A total of 75-150 emission tests will be conducted. Projects will include:

(a) Dual and single fuel CNG vehicles before and after conversion.

(b) New canister performance evaluation using various fuels.

(c) Develop method of reducing NOx emissions from vehicles using methanol, LPG and CNG.

(d) Develop system for sampling and analyzing unregulated hydrocarbons.

(e) Investigate low temperature effect of using methanol, LPG and CNG. (Report by July 1987).

Status Report - March 31, 1987

1. The testing program involving CNG and propane vehicles was continued from FY 85/86. Test vehicles are provided principally by Ottawa-Carleton Region, NCC and Gaz Métroplitan of Montréal.

2.(a) The joint TC/EC Methanol Vehicle Testing Program is continuing in FY 86/87 consisting of exhaust and evaporative emission testing of vehicles for unburned methanol and eight (8) species of aldehydes - principally formaldehyde. The three vehicles used in the first quarter were 1985 Toyota Camry, 1983 Ford Escort and 1983 Mercury Lynx. Current vehicles were provised by ESSO Research.

(b) In December a SHED methanol repeatability project was carried out for Transport Canada. Good correlation was achieved.

(c) VETL is conducting a cross-correlation program with Transport Canada Blainville laboratory to establish the quality of data output from their continuous methanol analyzer.

(d) Emission Tests - Methanol Project

Urban - 6
Highway - 7
LA-4 - 1
864H - 1
Evaporative - 6
Analyses of unburned Methanol - 125

3. Due to the concern that aldehyde emissions from gasoline-fuelled vehicles may be sufficiently high to present a health hazard, a testing project is underway to test several vehicles with different emission control technologies, i.e. unleaded gasoline with and without catalyst, and leaded gasoline (without catalyst).

Emission Tests - Aldehyde Monitoring Project

Urban - 36
Highway - 7
Analyses of Aldehydes - 125

4. VETL is testing a mini-CVS built in-house. The CVS will be used in evaluating catalytic converter efficiency under various operating conditions. Correlation between mini-CVS and maxi-CVS is encouraging.

Emission Tests (Mini-CVS)

Urban - 11

5. The aldehyde and unburned methanol sampling train, developed with the assistance of PMD and ASD is now in operation successfully in Lab #1. In addition, the methanol sampling train developed for use in the evaporative test chamber is now in place and operating. Measurements of unburned methanol are being made routinely.

6. On October 28, Fred Black, Chief of Mobile Sources, Research Triangle Triangle Park (RTP), EPA visited VETL and discussed alternate fuel test procedures and co-operative test programs. EPA has agreed to analyze methanol samples for cross-correlation purposes.

7. In December, three carbonyl reference standards sent for analysis to US EPA (RTP) in the cross-correlation program, showed very good correlation with VETL for aldehyde sampling. A round robin correlation program is being set up with several laboratories including VETL.

TESTING SUPPORT FOR REGULATION AND GUIDELINE DEVELOPMENT (98004)

Vehicle Emissions Testing Laboratory
Project Manager: Fred Hendren (998-9590)

Objective

To provide support to Transportation Systems Division in the form of vehicle testing projects for the development of regulations under the Motor Vehicle Safety Act and in-use vehicle guidelines for use by provinces and municipalities.

Relevance

It is essential that testing be carried out to assist in development of regulations and guidelines to eliminate the motor vehicle as a significant source of air pollution in Canada.

Work Plans

(a) Determine effects of MMT and HC emissions from 1981 and later US spec vehicles - 25 vehicles tested.

(b) Determine HC evaporative emissions using SHED method on Canadian spec vehicle - 50 tests (report by July 1987).

(c) Measure particulate emissions from diesels at FTP and CW conditions.

Status Report - March 31, 1987

1. A project is underway to evaluate the effects of the fuel additive MMT on the oxygen sensor in the exhaust system. Tests are run at intervals during mileage accumulation on a Pontiac Firebird.

2. The new vehicle standards starting with the 1988 model year require evaporative emission tests on each vehicle and also heat builds prior to each UDDS. VETL has undertaken a testing program to assess the possibility of using surface mounted thermocouples instead of in-tank installations due to the expense and time involved. This project is currently suspended.

MOTOR VEHICLE SURVEILLANCE (98005)

Vehicle Emission Testing Laboratory
Project Manager: Fred Hendren (998-9590)

Objective

To monitor and evaluate the performance, exhaust emissions and fuel economy of new and in-use motor vehicles, including suspect engine families both in the field and at VETL and to assess vehicles under cold weather conditions.

Relevance

This work assists in protecting the environmental concerns of Environment Canada and in setting future emission standards to prevent further increases in the total MV pollution burden.

Excessive emissions from the in-use vehicle fleet is a significant contributor to the air pollution burden in Canada. The work assists TSD in ameliorating this problem through investigation, identification and, finally, initiation of corrective action.

Work Plans

(a) New Vehicles - up to 55 vehicles per year and one to 12 emission tests and one or more SHED tests per vehicle.

(b) In-Use Vehicles - minimum 150 vehicles per year, and minimum 150 emission tests and 50 SHED tests.

(c) Cold Weather - four instrumented vehicles and 40 emission tests.

Status Report - March 31, 1987

1. A project was started in July 1984 to measure the exhaust and evaporative emissions and fuel consumption of compliance vehicles under conditions of maltuning, disablement or removal of various components including catalyst, EGR, air systems, oxygen sensor and fuel delivery circuit. Testing is done at both ambient and FTP conditions. Vehicles used were 1986 model Ford Escort, Chevrolet Caprice, Chevrolet Chevette and Dodge Aries. The program has now been expanded to include high speed steady-state testing at 90 and 120 km per hour together with idle tests. A total of 44 steady-state and 48 idle tests were conducted.

   Emission Tests (Vehicle Tampering)

   Urban - 106
   Highway - 21

2. A test program to monitor the exhaust and evaporative emissions, vehicle hardware tampering and fuel economy of private in-use vehicles was initiated in July 1984 consisting of complete emission tests before and after a thorough vehicle tune-up. The progam is continuing.

   Emission Tests (In-Use Surveillance)

   Urban - 2

3. The ambient temperature testing projects suspended in April 1986 started again in January, 1987 when weather conditions were more suitable and test cell #3 became operational.

Emission Tests (Ambient Temperature)

Urban - 42

TECHNICAL ADVICE AND ASSISTANCE (98006)

Vehicle Emission Testing Laboratory
Project Manager: Fred Hendren (998-9590)

Objective

1. To provide a service free of charge to the public, institutions and government agencies in the form of vehicle testing and evaluation, loans of technical equipment and training of outside personnel.

2. To provide a testing service on a fee basis to commercial, industrial, institutional and government clients.

Relevance

This service plays an important role in furthering the aims of the Department and is not available elsewhere within the Federal Government. It also provides outside funds to permit completion of high priority work.

Work Plans

(a) Complete 50 requests for technical assistance and information.

(b) Conduct 100 to 200 emission tests and investigations.

(c) Conduct 30 to 50 emission tests and 10 to 20 evaporative tests on 20 vehicles on a contract basis for a fee.

(d) Evaluate 10 to 15 fuel saving devices and additives to a total of 50 emission tests.

(e) Attend court cases as expert witnesses.

(f) Assist Regions in setting up test and tune clinics.

Status Report - March 31, 1987

1. Technical Assistance Information

(a) Corrected instrumentation problems at TC Blainville Test Centre.

(b) Corrected engine problems on methanol vehicles for Transport Canada.

(c) Assisted Ministry of Transport (Ontario) with lab correlation problems by sending VETL Buick Century for testing.

(d) Assisted Transport Canada to verify claims by Chrysler that extra cooling fans reduce CO emissions through improved air distribution. A mini-project was completed using a Voyageur van.

Emission Tests - Cooling Fans

Urban - 6

(e) Principal visit during 1st quarter was by a class of 30 students from Ingersol High School on May 8, 1986. Information was provided on emission testing and the role of VETL.

(f) Leased electrical dynamometer and provided instruction on its operation to Davis Engineering in May 1986. This company is carrying out a project for Transport Canada involving a comparison of vehicle road HP with dynamometer HP in order to arrive at a realistic correlation factor.

(g) Assisted Transport Canada, Blainville Test Laboratory in setting up a total quality assurance program including instrumentation, procedures for their Cold Weather alcohol program and cross-correlation testing.

Emissions Tests (Blainville Vehicle)

Urban - 3

(h) Provided Davis Engineering with instrumentation, procedures, and facilities advice required by them to set-up a complete exhaust emission test laboratory for a foreign car manufacturer.

2. Contract Testing

(a) Dacia model 1410 GTL S/W

Contract testing on May 13 and 14, 1986.

(b) Skoda model 120 GLS

Contract testing on May 23 and September 4 and 5, 1986. Tests were done as certification for the 1986 models. The main purpose was to verify that the emission control hardware complied with Standards. VETL provided considerable assistance in development of the hardware. Rep was Chris Rines.

(c) Magna Corp GSM model

Contract testing in June 1986. This is a prototype vehicle designed for ambulance and taxi service. It was developed by Magna Corp R&D Centre, Markham, Ontario. Fitted to the vehicle was an experimental catalytic converter developed by Hungarian engineers who witnessed the emission testing. The tests were successful, except for structural problems with the catalyst container. Magna will be using VETL for future contract testing.

(d) KIA Besta and KIA Besta Diesel

Contract testing on June 5 and 6 and August 20, 26 and 27, 1986. These are prototype passenger vehicles built by the KIA Manufacturing Co of South Korea. The tests were for certification verification prior to introduction of the vehicle into Canada in the near future. Company representatives from South Korea witnessed the testing.

(e) Bombardier-Daihatsu

Contract testing on September 2, 1986. This is a sub-sub-compact car being developed jointly by Bombardier & Daihatsu. The testing consisted of preliminary, simulated, modal analysis.

(f) Aurora

Contract testing on September 17, 24 and 25, 1986. This is an excellent replica of the AC Cobra and is manufactured by Aurora Cars Ltd. VETL is providing technical assistance to permit the vehicle to meet U.S. standards as it is being introduced into the U.S.A. Additional testing was carried out December 16-18.

(g) Terra Power

Contract testing on November 10 and on December 2 and 17. The vehicle which has an air-cooled three cylinder engine and is of Rumanian origin.

(h) Emission Tests (Contract)

Urban - 22
HWFCT - 8

3. Evaluation of Fuel Saving Devices and Additives

(a) Petro-Miser

This device is attached to the fuel line of a vehicle and is supposed to improve fuel economy by re-arranging gasoline molecules through magnetism. Testing was carried out in May and June at the

request of Consumer & Corporate Affairs. The device has a retail price of $200. A 1982 Buick Regal was used as the test vehicle. Testing showed that the device was ineffective. Charges of misleading advertising by the Crown are planned.

(b) PED (Petroleum Economy Device)

This item is a partial air-bleed device and has been on the market for several years. Litigation by the Crown is in progress and P. Tuck served as an expert witness during the first phase of Court proceedings from 7 to 11 April, 1986. At the request of Consumer and Corporate Affairs, VETL re-tested the PED in May and June using two VETL test vehicles, 1978 Volaré and 1978 Chevrolet BelAir. PEDs were installed and adjusted by Dave Felton of Ferry Cap and Screw of Cleveland, Ohio. Felton, Mike Leshner of Ferry and Ron Chapman, defence attorney witnessed first series of tests. Results of the testing showed that exhaust emissions and fuel consumption were higher with both vehicles with the PED installed than baseline tests run early in May after tune-up to manufacturer's specs. The Court will re-convene in March for two weeks.

Emission Tests Fuel Saving Devices

Urban - 18
HWFCT - 15

4. Assistance to Regions

As part of Environment Week in June, a series of vehicle test clinics were held in several cities in Canada. In order to assist Regional personnel to set up the clinics, VETL held a test clinic training session on 15 May 86. There were a total of four attendees from the Atlantic, Pacific and Québec Regions. Instruction was provided by E. Langevin, R. McAskill, F. Lavallée and D. Cope.

APPENDIX A

Manuscript (unedited) Reports

1. "10 um Inhalable Particulate Sampling in Canadian Urban Areas: Mass, Sulphate, Nitrate, Lead and Bromine Results (May 1984 to March 1985)", May 1986.

2. "A Catalogue of Oil Properties". EE-77, March 1986.

3. "A Study of the Mechanism of Chemical Dispersion of Oil Spills". EE-76, March 1986.

4. "A Summary of Source Sampling Methods used to Evaluate the Flakt Pilot Plant at the Quebec City Mass Burning Incinerator", Cianciarelli, D., and Williams, B.D., December 1986.

5. "Ambient Air Concentrations of Volatile Organic Compounds in Toronto and Montreal", TS-6, October 1986.

6. "Ambient Air Measurements of PAH of Notre Dames des Champs School and Lees Avenue Transitway, Ottawa-Carleton", June 1986.

7. "An Experimental Study of Oil Spill Treating Agents that Inhibit Emulsification and Promote Dispersion". EE-87, December 1986.

8. "An Interlaboratory Study of the Measurement of PCB in Transformer Oil".

9. "Benzene in the Ambient Air at Canadian Urban Areas". February 1987.

10. "Chlorinated Organics Analysis of Samples from Northern Wood Preservers Inc., Thunder Bay, Ontario". February 1987.

11. "An Exploratory Study of the Buoyancy Behaviour of Weathered Oils in Water". EE-85, June 1986.

12. "Follow-up Study of a Sulphuric Acid Spill Near Springhill, N.S.". EE-86, July 1986.

13. "In-site Treating Agents for Chemical Spills". EE-83, April 1986.

14. Long Term Fate and Persistence of Stranded Oil at Cape Hatt, N.W.T. and from the AMOCO CADIZ Spill". EE-84, June 1986.

15. "Methodology for Organic Analysis - NITEP/Flakt Project". September 1986.

16. "Modelling the Spreading, Infiltration and Evaporation of Chemical Spills on Grass and Impermeable Surfaces". EE-78, October 1986.

17. "NITEP - Trace Organic Contaminants Quebec City Incinerator Combustion Air Supply", McCaig, R.B., and Chiu, C., February 1987.

18. "Pack Ice in Canadian Waters: Dimensions and Dynamics of Leads and Floes". EE-82, April 1986.

19. "PCDD/PCDF Analysis of Ambient Air Samples from an Open Burning of Waste Wood in B.C." May 1986.

20. "PCDD/PCDF Analysis of Norsk Hydro Effluent Samples". September 1986.

21. Proceedings of Ninth AMOP Technical Seminar, June 10-12, 1986.

22. Proceedings of Fourth Technical Seminar on Chemical Spills, February 10-12, 1987.

23. "Remote Sensing Chronic Oil Discharges". EE-80, May 1986.

24. "Spreading of Chemicals on Ice and Snow". EE-79, December 1986.

25. "Summary of Analytical Protocol for the Determination of PAH in Ambient Air Samples". September 1986.

26. "Survey Proposal, Stack Sampling Program to Evaluate Coal Water Fuel Technology on a Power Boiler at Maritime Electric Company Limited, Charlottetown, P.E.I.", Cianciarelli, D., November 1986.
Creek Sewage Sludge Incinerator", Leung, P.K., August 1986.

27. "Survey Proposal to Measure the Emission of Particulate, Metals, NOx, SO2, CO2, CO and Selected Trace Organic Contaminants from the Dufferin

28. "The Baffin Island Oil Spill Project". Environment Canada and the Canadian Petroleum Association, June 1986.

29. "The National Incinerator Testing and Evaluation Program (NITEP): Air Pollution Control Technology, Volume III", Cienciarelli, D., and Williams, B.D., February 1987.

30. "Thermal Destruction of a Coal Tar Pond Sediment Sample from Sydney, Nova Scotia", Williams, B.D., and D'Addario, F., February 1987.

31. "Thermal Destruction of Herbicide Residues", Williams, B.D., and D'Addario, F., July 1986.

32. "Use of GC/MSD for Environmental Analysis". April 1986.

Environment Canada (edited) Report Series

1. A Catalogue of Oil Spill Containment Barriers. Report EPS 9/SP/1, September 1986.

2. EnviroTIPS Manual - "Zinc Sulphate", May 1985.

3. EnviroTIPS Manual - "Sulphur Dioxide", June 1985.

4. EnviroTIPS Manual - "Butyraldehydes", June 1985.

5. EnviroTIPS Manual - "Naphtha", April 1985.

6. EnviroTIPS Manual - "Sodium Sulphate", June 1985.

7. EnviroTIPS Manual - "Tetraethyl Lead", April 1985.

8. EnviroTIPS Manual - "Urea", May 1985.

9. EnviroTIPS Manual - "Ethylene Oxide", May 1985.

10. EnviroTIPS Manual - "Introduction", August 1985.

11. "National Air Pollution Surveillance - Annual Summary 1985". Report EPS 7/AP/18 - October 1986.

12. "National Air Pollution Surveillance - Monthly Summary"; from October 1985 to September 1986. Reports EPS 7/AP/10-85; 11-85; 12-85; 1-86;
13. "Oceanographic Conditions Suitable for Sinking of Oil. Report EPS 3/SP/2, May 1986.
2-86; 3-86; 4-86; 5-86; 6-86; 7-86; 8-86 and 9-86.

14. Spill Technology Newsletter, Vol. 11 (1) March 1986, Vol. 11 (2) June 1986, Vol. 11 (3) September 1986, Vol. 11 (4) December 1986 and Vol. 12 (1) March 1987.

Technical Papers

1. Belore, R. and Bobra, A.M., "Development of an Extreme Emergency Analytical System", presented at the Fourth Technical Seminar on Chemical Spills, Toronto, Ontario, February 1987.

2. Bobra, A,M. "Survey of Air Monitoring Meters for Spill Use", Spill Technology Newsletter Vol. 11 (4), December 1986.

3. Dann, T., "Air Quality Problems and Implication of Alternative Fuel Use". Symposium on Priorities for Research and Development on the Environmental and Health Implications of Using Alternative Fuels", Ottawa, Ontario, June 1986.

4. Dann, T., "Photochemical Oxidants: Formation and Control". CELRF Symposium - "Beyond Acid Rain"., Toronto, May 1986.

5. Dann, T., Gonthier, C., "Measurement of Volatile Organics at an Abandoned Waste Disposal in Montreal, Canada". ACS National Meeting, Anaheim, Calif. September 1986.

6. Dutton, R. and Whitt . "Cleanup from the Pesticide Warehouse Fir - Canning, Nova Sco presented at the Fourth Technical Seminar on Chemical Spills, To to, Ontario, February 1987.

7. Dutton, R. "Canning, Nova Scotia - Pesticide Warehouse Fire Reverse Osmosis Cleanup", Spill Technology Newsletter Vol. 11 (4), December 1986.

8. Donison, H., Whittaker, H., Tremblay, J. and Dutton, R. "Development and Demonstration of a Mobile Reverse Osmosis/Adsorption Treatment System for Environmental Cleanups", presented at the Fourth Technical Seminar on Chemical Spills, Toronto, Ontario, February 1987.

9. Fingas, M.F., "The Development of Better Input Parameters for Chemical Spill Models", presented at the Seminar on Chemical Spill Modelling, Atmospheric Environment Service, Downsview, Ontario, February 1987.

10. Fingas, M.F., "Spill Response Protection", presented at the Workshop on Industrial Safety, Ontario Society for Pollution Control, Toronto, Ontario, March 1987.

11. Fingas, M.F., Kawamura, P., Mackay, D., Belore, R. and Buist, I., "Input Parameters for Chemical Spill Models" presented at the 1986 Chemical Spill Conference, St. Louis, Missouri, May 1986.

12. Fingas, M.F., "Laboratory testing of Dispersants", presented at the Norwegian Seminar on the Dispersion of Oil at Sea, Trondheim, Norway, November 1986.

13. Fingas, M.F. "Laboratory Studies on the Chemical and Natural Dispersability of Oil". Accepted for presentation at the 1987 Oil Spill Conference, Baltimore, MD, April 1987.

14. Harris, G.W., Wells, P.G., Bobra, A.M. and Abbott, F.S., "The Comparative Toxicology of Oil Spill Dispersants to Fish", presented at the Ninth Arctic and Marine Oilspill Program Technical Seminar, June, 1986.

15. Lao, R.C., et al. "Analytical Procedures to Assay Environmental Samples for PCDD/PCDF, PAH, PCB, CB and CP", Chemosphere, Vol. 15, No. 8-9, p. 906, 1986.

16. Lao, R.C., et al. "Measurement of PCDD/PCDF from Incinerator and PCP Samples", Chlorinated Dioxins and Dibenzofurans in Perspective, Chapter 23, Lewis Publishers Inc., 1986.

17. Lao, R.C., et al. "Refined Analytical Procedures to Detect and Measure PCDD/PCDF, PAH, PCB, CB and CP in Environmental Samples". Presented at the 6th International Symposium on Dioxin and Polychlorinated Hydrocarbons, Fukuoka, Japan, September 1986.

18. Lao, R.C., et al. "Chromatographic Separation and Identification of PCDD/PCDF Isomers by CI and EI Mass Spectrometry". Presented at the 6th International Symposium on Dioxin and Polychlorinated Hydrocarbons, Fukuoka, Japan, September 1986.

19. Meikle, K.M. "Technology Development by Environment Canada for Chemical Spill Response", presented at Response '86, Vancouver, B.C, September 1986.

20. Mills, W.J.M. and Bobra, A.M., "Continuing Development of a Vehicle-Portable Analytical System", presented at the Fourth Technical Seminar on Chemical Spills, Toronto, Ontario, February 1987.

21. Owen, E.H., Humphrey, B. and Sergy, G. "The Migration of Stranded Oil from a Sheltered Beach into Adjacent Nearshore Subtidal Sediments", presented at the Conference on Fate and Effects of Oil In Marine Ecosystems, Amsterdam, Netherlands, February 1987.

22. Ruttan, T. and Bobra, A.M. "Continuing Development of a Person-Portable Analytical System", Fourth Technical Seminar on Chemical Spills, Toronto, Ontario, February 1987.

23. Sergy G.A. and Blackall, P.J. "Designs and Conclusions of the Baffin Island Oil Spill Project". Accepted for publication in the Journal ARCTIC, In Press.

24. Whittaker, H. "Emergencies Spill Cleanup Using Reverse Osmosis", presented at the Wastewater Technology Centre Workshop - "Membrane Technology - Scale-up and System Design", Burlington, Ontario, July 1986.

25. Whittaker, H. "Applications Testing with the Environment Canada Mobile Reverse Osmosis Unit", presented at the Canadian Society of Chemical Engineers Convention, Sarnia, Ontario, October 1986.

26. Whittaker, H. "Laser Ignition of Oil Spills". Accepted for presentation at the 1987 Oil Spill Conference, Baltimore, MD, April 1987.

APPENDIX B

Director's Office

BRUER, Lyle - Stores
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McASKILL, Ron - Head, Test Unit
MOODIE, Ron - Technician
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WILLIAMS, Don - Chief
YEATMAN, Rick - Technologist, Ambient Meas.